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ABSTRACT

Researchers attempting to identify factors that affect the participation of Mexican American females in science courses and careers studied cultural, social, and educational factors affecting 2,442 Arizona secondary school students. Questionnaire responses and interviews with the students and their teachers, counselors, and parents revealed that ethnic and sex differences in science and math courses taken increased over time, with Anglo males most likely to take or be interested in taking science and math and to plan for science and math careers. Cultural factors associated with science interest included language spoken in the home, academic competence, family orientation, and self-perceptions. Social factors affecting interest included parental and peer opinions of the importance of science and college attendance. Mexican American parents provided much general encouragement and support of science courses but little focused assistance. Mexican American girls anticipated negative reactions to their science interests. Educational factors included caring about science; trying hard in science classes; and perceptions of science usefulness and of the factors associated with interest in science and complex, non-linear relationships. Teachers and counselors can help students by providing current, non-sex-stereotyped career and education information. (SB)

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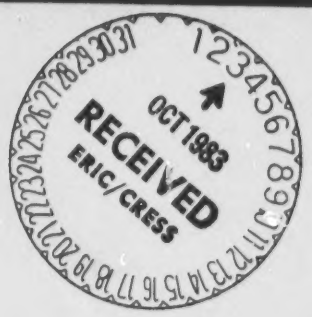

SOCIAL INFLUENCES ON THE PARTICIPATION OF MEXICAN-AMERICAN WOMEN IN SCIENCE

FINAL REPORT

National Institute of Education Grant NIE - G - 79-0111

May, 1983

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INTRODUCTION

The objective of this research is to identify social factors that hinder or facilitate the participation of Mexican-American females in courses and careers in science. While previous research in the field has focused on barriers to female participation in general, few works have examined Mexican-American women. This research seeks to differentiate those factors that affect females, those that affect Mexican Americans, and those that affect Mexican-American women. Of particular interest will be to investigate whether Mexican-American women suffer from a "double disadvantage."

OVERVIEW OF THE PROBLEM

Social scientists have documented the effects of race, ethnicity and gender on occupational stratification. The general conclusion of these studies is that the higher the occupation in terms of the status and prestige, the fewer the number of women and minorities who are found (Blau, 1979). Occupational segregation by sex and ethnicity is particularly evident in science, which until recently was almost exclusively the domain of white males. Science may be a last bastion of white male dominance because the scientific professions require advanced, specialized training and are occupations that are highly regarded in our technologically oriented society.

Although women remain underrepresented in science, in the last ten years their position relative to men has improved. In terms of educational attainment, women's share of bachelor's, master's, and doctoral degrees in

the biological and physical sciences increased from 1971 to 1977 (Brown, 1979). By 1977, women were receiving 24 percent of all doctoral degrees, 21 percent of those in biological sciences and 9.6 percent of those awarded in physical sciences. These trends are likely to continue insofar as graduate enrollments in 1978 indicate that women represent 46 percent of all graduate students, 35 percent in the biological sciences and 18 percent in the physical sciences (National Science Foundation, 1980a). In the area of work, employment of women scientists increased faster than men between 1976 and 1978 (National Science Foundation, 1980b). The result is an increase in the percentage of employed scientists who are women.

While the participation of minorities in science has also increased, they still remain greatly underrepresented. Minorities represented 18 percent of all undergraduates in 1978 and comprised 17 percent and 10 percent of the majors in the biological and physical sciences respectively (National Science Foundaiton, 1980a). Although 10 percent of all graduate students were minorities, seven percent of the biological and six percent of the physical science students are minorities. Thus, minorities continue to be underrepresented as science majors insofar as Blacks, Native Americans and Hispanics together accounted for 18 percent of the population.

When the minorities are separated into their respective groups, the differences between the ethnic groups become apparent. Relative to their size, Asian and Native Americans earn a more representative share of degrees in science than do Blacks and Hispanics. Hispanics are estimated to be nearly six percent of the U.S. population. However, Hispanics received less than two percent of the bachelor's degrees and less than one

percent of the master's and doctoral degrees in science in 1975-76 (National Science Foundation, 1980a). In terms of employment, the figures indicate that in 1974 five percent of all employed scientists and engineers were minority group members; however, a mere .001 percent of all employed scientists and engineers were Mexican Americans (National Science Foundation, 1977).

The effect of being both a woman and an ethnic minority magnifies the barriers to participation in science. Because the percentage of degrees in science which are awarded to minorities in small, the figures usually are not broken down by sex. But of all science doctorates (including those in the social sciences) awarded in the United States in the 1970's, 8643 went to White women, 814 to Black women and only 35 to Mexican-American women (NAS/NRC Commission on Human Resources, 1977). In employment, only one percent of all employed scientists and engineers were minority women in 1974 (National Science Foundation, 1977). Undoubtedly, the percentage of these women who are Hispanic is quite small.

Even though, the position of minority women in science is not statistically well documented, the obstacles to their success in education and employment have been explored in interviews and conferences (Malcom, Hall and Brown, 1976; Erlich and Lebold, 1977: Menard, 1979). These reports demonstrate that these women have perservered in spite of encountering racism and sexism in their training and careers. Minority women have been seen as different both in the scientific professions and in their own cultural group because of their nontraditional career choices.

Factors Influencing Participation in Science

Numerous factors have been offered to account for the sex and ethnic differences in participation in science. These explanations can be divided into four general areas: cognitive characteristics, cultural characteristics, social factors and educational factors.

Reports that minority and female students use cognitive styles that are more field dependent and score lower on various measures of spatial visualization and specific cognitive skills have been cited as explanations of sex and ethnic differences in science and mathematics. This research does not explore the relationship of cognitive characteristics to participation in science for three reasons. First, the connections between various cognitive skills and science have not been clearly established. Second, measures of cognitive ability are confounded with the sex and ethnic factors which they seek to illuminate. Third, the differences in cognitive skills are due, at least in part, to social and cultural factors which are best understood by direct examination.

Three cultural characteristics have been examined with respect to education. First, language ability may be related to science insofar as adequate preparation in English is related to academic success and bilingualism may contribute to a more heterogeneous, diversified cognitive style. Second, familism has been portrayed either as a barrier to individual success or as a support necessary for goal achievement. Third, although the prediction was that acculturation would be related to educational achievement, those students who identify with the Mexican-American culture are more academically successful. Therefore, competence in English

is expected to be related to participation in science but other cultural characteristics are not expected to be influential.

Social factors are divided into three areas. First, socioeconomic factors have been explored in the past to account for ethnic differences. The concentration of Mexican Americans in the lower occupational and educational categories may limit the resources, information and examples they can provide for their children. Second, there may be systematic differences in the support and encouragement that minority students and girls receive with respect to their interest in science and mathematics. Although Mexican-American parents are as supportive of education at a general level as Anglos, they may have less interest and knowledge about science and mathematics. Similarly, although girls may receive encouragement to finish high school or attend college, they are usually counseled to pursue more traditional fields. Insofar as the peer group is homogeneous with respect to sex and ethnicity, peer encouragement and support will perpetuate rather than challenge tne patterns of interest in science and mathematics. Finally, social stereotypes continue to influence beliefs about sex appropriate behavior. Not only are girls affected by stereotypes that achievement contradicts the female role, but science and mathematics, in particular, are seen as "masculine" pursuits. Therefore, parents and peers are expected to provide less support and encouragement for Mexican-American and female students. Students who are traditionally oriented toward sex roles are predicted to be less interested in science and mathematics.

The educational context is particularly important in influencing participation in science and math. Students' course selections are affected by their past experience, including their likes, dislikes, grades, and effort, and their future expectations, i.e., the usefulness of the subject matter for adult roles and job opportunities. Two structural characteristics of schools, the ethnic composition and the curriculum and tracking, provide the framework within which educational decisions are made. Teachers and counselors may be particularly influential in the advice and encouragement they provide. Insofar as teachers' and counselors' expectations and responses are differentiated by sex and ethnicity, they may help perpetuate the pre-existing differences in students' attitudes and school structure that result in lower participation in math and science by girls and minorities.

PLAN OF THE RESEARCH

This research seeks to identify social influences on the participation of Mexican-American women in science. The study focuses on interpersonal factors and intrapersonal factors that arise from social, cultural and educational institutions. At the intrapersonal level, self-image and attitudes are of primary concern. Because of societal expectations as to the appropriateness of science and technology as fields for women and because of the importance of family roles to Mexican Americans, this research examines the effect of gender role attitudes. Specifically, attitudes about careers for women, attitudes about combining career and family roles, and attitudes about differentiation of activities by gender are investigated. Attitudes about school and educational and occupational aspirations are

other crucial attitudes which are included for study. Finally self-image and background characteristics are measured to determine the influence of these features on participation in science.

The interpersonal level is examined from two perspectives. First, young people are questioned about their perceptions of the expectations, support, and encouragement they receive from others in their social networks. Second, parents, teachers, and counselors are questioned with respect to the encouragement they provide to adolescents.

Methods

Research Sites

Information from adolescents was gathered using a questionnaire that was distributed during school hours to high school and junior high students in six schools in southern Arizona. The six schools included in the study were selected on the basis of the proportion of minority students enrolled. Students who identified themselves as Mexican or Mexican American were the modal ethnic group in each school. The two school districts were chosen as the research sites because they represent different types of school populations. The first site, in Nogales, Arizona, is located in a town of 12,000 that borders with Mexico and has a populace with very close cultural ties with Mexico. Nogales, Sonora has a population of nearly 53,000. Eighty-nine percent of the students in the school system are Mexican-American. One high school and one junior high serve the entire community. In addition, about one percent of the students cross the border and pay tuition to attend school in the United States.

The second site in Tucson, population 520,000 has an urbanized student population that is thirty-five percent minority; the majority of that group is Mexican-American. Because the Tucson Unified School District is the largest school district in Arizona, there is variation in the student compositon of different schools. For this particular study, the two high schools with the largest proportion on minority students and the junior high schools that serve these high schools were included in the study.

Questionnaires

Because questionnaires were to be distributed in class, students could not be selected randomly from the school population for participation in the study. Required classes at each grade level were used as the sampling units. For example, in the seventh grade all students might be required to take math, in the eighth grade, English. The use of required classes was the best way to ensure that all students in a given grade had a chance to participate.

Consent to participate was obtained from students and parents. Several days before the questionnaires were to be distributed, students took home a bilingual letter, which the parents were to return if they did not want their child to participate in the study. Students could also refuse to fill out the quesionnaire. Overall, the response rate was quite high. Less than four percent of the Tucson parents and less than one percent of the Nogales parents returned the letter. In Nogales only one percent of the students refused to fill out the questionnaire. In Tucson, the refusals ranged from six to thirteen percent.

The bilingual questionnaire was completed by a total of 2442 students. Of these, 835 were from junior high schools, and 1607 were from high schools. This response exceeded the goals of 700 junior high and 1300 high school students. Only nine percent were unable to complete the entire questionnaire, but most of these completed the sections on sex role attitudes, attitudes toward school, educational and occupational aspirations, social support, and students' demographic characteristics.

Since most of the questions were designed with pre-coded, closed answer choices, the information was easily transferred to coding sheets. The reliability of the coding was quite high with only one error per 1,000 codes. The key punching was also quite accurate with only one error for every 10,000 punches.

Interviews

Interviews were conducted with teachers and conunselors form the six school in the study plus a few teachers from an additional high school. The goal was to obtain 100 interviews, half of these with math and science teachers. Interviews were completed with forty-six math and science teachers, forty teachers of other subjects and fifteen counselors. The teachers were fairly evenly divided on gender. In terms of ethnicity, the majority were Anglo, with thirty-one percent of the male and six percent of the female teachers, and nearly forty percent of the counselors identifying themselves as Mexican American.

The interview schedule was designed to utilize as many questions as possible that were similar to the student questions. The interview began with general questions about teaching experience, interaction with students,

typical problems encountered, and ways that the educational system could be improved. Next teachers completed a set of background items and the same gender role questions to which students responded. Finally, teachers were presented a brief description of six hypothetical situations and asked what advice they would give and what factors they took into account. By varying the names of students, sex and ethnicity were systematically varied.

Parents of eighth, tenth and twelfth grade students were located by randomly selecting three or four classes from each of these grade levels per school. When a letter sent home with students failed to elicit much response, parents were contacted directly by phone or mail. Of the 449 names with which we began, interviews were completed with 260 or fifty-eight percent. The response rate is sixty-eight percent when those who were not contacted and those who had moved are not included. We were unable to reach our goal of 300 interviews due to the time necessary to locate each parent. Half of the parents came from Nogales, and more than forty percent identify themselves as Mexican American. Because of the difficulties in locating parents, no attempt was made to select one parent or the other. Thus, twenty-five percent of the parents were fathers and seventy-five percent were mothers.

Parents were asked how well they thought their child did, in what ways they encouraged the child, what their aspirations for the child were, how involved they were with school activities, and what their overall evaluation was of the school system. The interview concluded with background characteristics, reactions to the interview, and the gender role questions.

Interviewers

The interviewers, who were all bilingual, were selected on the basis of previous experience and two personal interviews with staff members. Of the eight, three were women and four were undergraduate students at the university. They ranged in age from 22 to 54. The interviewers received approximately ten hours of training and feedback throughout the data gathering process on how to improve their interviewing techniques. In this way, potential problems were corrected before they affected many cases.

The teacher interviews were done by six interviewers, two women and four men. Because the parent interviews were to be conducted in the respondents' homes, only the most reliable and conscientious interviewers were used in the parent interviews. Although four interviewers were used for the parent interviews, one man was responsible for sixty-eight percent of those interviews.

RESULTS

Two background characteristics are of primary importance in this study: sex and ethnicity. Students were asked whether they were male or female and to check which ethnic labels they would use to describe themselves. Approximately a quarter of the respondents selected White/Anglo. Nearly sixty percent checked Mexican-American and thirteen percent picked Mexican. Native American accounted for almost seven percent followed by a very small percent who chose Black, Asian American and other ethnic groups. Because students could select more than one ethnicity, the following categories were created. All those who identified themselves as Mexican or Mexican American were classified as Mexican Americans (N = 1588). Of the remaining

students, those who checked White/Anglo were considered Anglos (N = 476). Those of all other ethnicities (N = 378) were excluded from the analyses because they were too few in any single ethnic group for statistical comparison and the characteristics of these ethnic groups are too diverse to consider them together.

Participation in Science

The focus of this study, participation in science, was assessed by three measures: course taken, desire for a career in science, and interest in taking science courses.

Courses Taken in Science and Math

First, there is variation in the curriculum. One school system offers biology and math on a bilingual basis and provides a second year of biology, oceanography and computer math for interested students. Earth science is the only addition to the usual offerings in the other school district.

Differences in the total number of science and math courses students reported taking reflect the effects of sex, ethnicity and curriculum. First, the range of choices is related to school district and grade. Regression analysis was used in order to consider the effects of grade, school district, sex and ethnicity on courses taken. As can be seen in Figure 1, grade has a linear effect on number of science courses taken. There are two grades where there is no change: the comparison of eighth and ninth and eleventh and twelfth grades. The first comparison reflects the structure of the curriculum. The first science course

available to students in high school is biology, which is usually taken in the sophomore year. The second comparison reflects students' enrollment in electives. After completing biology, which is required for high school graduation, few students go on to take science in the eleventh and twelfth grade. The lack of a significant difference between students in these class levels is indicative of the fact that very few students take science in both these grades. In fact, the high schools recommend only two years of high school science for students who are planning on attending college. Since most students take biology during the sophomore year, they could only complete three years of high school science before they graduate. However, most stop at the minimum required and complete a total of only three courses in junior high and high school.

The effects of sex and ethnicity are also evident in Figure 1. At each grade level, girls report having taken fewer courses than boys of the same ethnicity. Overall, Mexican Americans report fewer science courses than Anglos. The only exception to this pattern occurs in the seventh grade where Anglos enter at a relative disadvantage compared to Mexican Americans. By the eighth grade, Mexican Americans' advantageous position has been reversed. This ethnic difference reflects variation in the curriculums between the two school systems. In Nogales, students are offered science courses in both the seventh and eighth grades; one focuses on life sciences, the other on physical science. In Tucson, students do not take science until the eighth grade. At one of the junior highs, students receive a year long course in general science. At the other, students can select three of the four quarter-length units offered in science. Since

Mexican Americans are more heavily represented in Nogales, the ethnic difference in the seventh grade corresponds to the structure of the curriculum. Finally, it should be noted that fitting grade, sex, ethnicity, and the effect of being an Anglo seventh grader accounts for thirty-eight percent of the variance in the number of science courses taken. Other parameters for particular school district or for combinations of sex, grade, and ethnicity did not significantly improve on this model.

The model for number of math courses taken is more complicated. As can be seen in Figure 2, the effects of sex and ethnicity are not linear but interact with grade level. This means that differences between the sexes and ethnic groups are initially small but increase over time. The math curriculum is more structured because more math than science is required. Students in both districts take math in the seventh and eighth grades. In high school, one year of math is required for graduation although two years are recommended for students planning to attend college. Most students continue to take math after they have met graduation requirements and leave high school having completed four or five math courses.

In addition to the effects of grade and the interactive effects of ethnicity and sex with grade, the school district the student attended has a significant effect. Because of the greater variation in the courses offered in Nogales, students in that district report having taken more math than do students in Tucson. Four additional parameters which account for specific sex, grade and ethnic combinations are also included in this model. When all eight parameters are included, the model accounts for fifty-seven percent of the variance in number of math courses taken. The

reduction in the number of math courses reported by twelfth grade Anglos in Nogales reflects the small number of Anglo students in these categories rather than a reversal of the general pattern in which Anglos report more math at other grade levels. The overall pattern of these analyses is that sex and ethnic differences are quite small until students complete the minimum amount of math. Although there is some variation in the amount of math taken in the tenth and eleventh grades, by eleventh grade Anglos have completed more math than Mexican Americans and boys more than girls.

Specific Courses Taken

Enrollments in math and science courses are presented in Table 1. Log linear analyses were used to determine whether participation in particular courses was related to sex and ethnicity. Overall, the results indicate that there are more ethnic differences than sex differences. Ethnicity but not sex is related to science courses in six cases. Anglos are 1.8 times more likely to have taken general science and independent study in science, 1.7 times more likely to have taken chemistry and 1.6 times more likely to have taken earth science or to have been a science lab assistant. Mexican Americans are 2.1 times more likely to have taken physics, but this is the only course in which they are over-represented. Enrollment in physical science is related to sex but not to ethnicity; boys are 1.3 times more likely to have taken it. Biology I and II, and oceanography, are independent of sex and ethnicity; bilingual biology is independent of sex.

The associations with ethnicity reflect preparation for college. Chemistry and physics are suggested for students who desire to go to

college. These results indicate that Anglos who continue in science take chemistry, the most popular of the elective science courses. Mexican Americans who continue in science are more likely to enroll in physics. The difference with respect to independent study and being a science lab assistant may reflect the close interaction students in these positions have with teachers. In most cases, the science teachers are Anglo and, therefore, may be more likely to work with Anglo students. The sex difference in taking physical science parallels national trends which indicate that males are more likely to study the physical sciences and the few females in science are better represented in the life sciences. Whether the underlying difference appears to be the subject matter, the effects of individual interests or sex role stereotyping remain to be determined.

Turning to the math courses, again there are more differences by ethnicity than by sex, although there are a large number of courses taken as electives by a small percentage of students that are unrelated to either sex or ethnicity. There is no sex difference in participation in bilingual math and computer math, and no sex or ethnic differences with respect to business math, algebra II, college algebra, and calculus. Except for business math which is taken by nearly seven percent of the students and Algebra II which 16 percent take, these other courses have very small enrollments.

Two courses are associated with ethnicity and one course is related to both sex and ethnicity. Anglo students are 1.4 times more likely to have taken albegra I, and Mexican American are 1.6 time more likely to report general math. Since algebra I is the course that is usually taken to

fulfill the graduation requirement, these ethnic differences may indicate that Mexican Americans take a less specialized course to meet the requirement or need basic pre-requisites before they can take algebra. In either case, their ability to continue taking math and to take the more advanced science courses for which algebra is required is reduced. Geometry is related to both sex and ethnicity. Anglos and boys are more likely to take geometry by factors of 1.6 and 1.3 respectively. These differences may be due to spatial visualization skills which may be less developed for girls and Mexican Americans. Language may also contribute to the participation of Mexican Americans insofar as language skills may be more necessary for understanding geometry than the other more abstract and symbolic math courses. Pre-algebra is related to sex but not ethnicity. Boys are 1.3 times more likely to take this course. This difference reflects counseling and academic planning. Pre-algebra is offered in junior high as advanced preparation for students who will be taking algebra in high school. Boys may be more likely to anticipate their future course work, or they may be encouraged by parents, teachers, and counselors to consider their high school plans earlier than girls.

Careers in Science

Students were asked both their occupational aspirations and expectations. For the purposes of this report, the percentage of students interested in science is of particular interest. As can be seen in Table 2, only a small number of students are interested in careers in science. Because of the attrition as one proceeds through the

educational and occupational processes, until more students are interested in careers in science at the high school level, the number who continue on to receive undergraduate or graduate degrees in science will remain very small. The occupations were grouped into four categories; scientist, other professions, all other occupations, and don't know. Anglos are more likely to desire a career in science. The differences with respect to the other professions and other occupations are smaller, but Anglos are slightly more likely to pick professions and Mexican Americans are slightly more likely to choose nonprofessional occupations. Among the professions are the math related occupations, such as accountant, mathematician, computer scientist. Although the sex and ethnic differences with respect to careers in math do not reach significance, a predictable pattern emerges: 7.9 percent of the Anglo boys, 5.8 percent of the Mexican-American boys and 4.2 and 4.8 percent of the Anglo and Mexican-American girls respectively desire a job in a math-related field.

It should be noted that Mexican Americans are more likely to answer "don't know." Insofar as Mexican Americans are more undecided with respect to their occupational aspirations, they may not take the course work necessary to pursue careers in science, math, and other technological areas. Once such decisions about course work have been made by default, it becomes increasingly difficult to alter one's plans and take the necessary pre-requisites. The pattern of association with sex indicates that boys are more likely to choose scientist, nonprofessional occupations and "don't know;" girls are more likely to be interested in professions other than science. Girls are more interested than boys in all the professions listed except the science and math related occupations.

Occupational aspirations and expectations are contrasted in Table 2. Since some students selected more than one job as their preferred occupation, in the lower half of the table, first and second choices have been pooled. This table contrasts those students who picked scientist for either choice with those who expressed an interest in other occupations. Those students who were undecided are omitted. The sex and ethnic effects persist. Boys and Anglos are more likely to be interested in science. In terms of occupational expectations, some students believe that their abilities and the opportunities available will not enable them to realize their aspirations. The percentage of students whose occupational expectation is scientist is one to two percentage points lower than the percentage who desire a career in science. Although the drop is proportional to the number initially interested, when there are so few students interested in science to begin with, the number left who believe they will be able to become scientists is incredibly small. Less than two percent of the Mexican-American girls, that is eleven girls, think they will become scientists. Insofar as these girls are scattered across six schools, there is little possibility of peer support and encouragement among students who share occupational expectations. Until more students aspire to careers in science, but particularly more girls and more minorities, the number who pursue these aspirations, much less are able to achieve what they desire, will not increase.

Interest in Taking Science

Students were asked whether they would take science if they had a choice. They could choose from the responses yes, probably, no, and "don't

know." The results, presented in Table 3 and Figure 3, indicate that the responses are associated with both sex and ethnicity. The effect of ethnicity is larger than the effect of sex. Comparing the sexes, males are more likely to answer yes, females are more likely to give the other answers. The sex difference is of approximatley the same magnitude for the categories probably, no, and don't know. Anglos are more likely than Mexican Americans to be interested in taking science. Mexican Americans are more likely to respond probably, no or don't know. The relationship has a linear form. The negative attitudes of Mexican-American students toward science are striking. Between sixteen and nineteen percent of the Mexican Americans would not take science and an additional ten percent do not know. Sixty-three Mexican-American boys and fifty-four Mexican-American girls did not respond to this question and are excluded from the table. Overall, Mexican Americans express less interest in science and more uncertainty about their interest in science. Because uncertainty about taking science may be a separate dimension of interest, subsequent analyses will use only three categories of response to this question. Because there is more variation in interest in science than in number of courses taken or occupational aspirations, interest in science will be the primary focus of the remainder of this report.

Cultural Factors Associated with Interest in Science

Two aspects of language were examined. First, students were asked what language they spoke at home and with their friends. Language spoken at home is independent of interest in taking science. Language spoken with

friends is related for Mexican Americans such that those who speak only Spanish are less likely to be interested in taking science than those who speak only English or a combination of English and Spanish. Sex, however, continues to be influential. The second aspect focuses upon competence. Those students who report getting A's in English are the most interested in taking science. However, the second most interested group are those receiving D's followed by B and C students.

Grades in English do not account for the sex and ethnic differences as these variables continue to have independent effects (See Figure 4). The effects of sex and ethnicity on interest are nearly equal, hence the closeness of the lines for Mexican-American males and Anglo females. The result is that Mexican-American females are doubly disadvantaged as their interest is reduced by sex and ethnicity.

In terms of the association of grades with sex and ethnicity, girls are more likely to report A's and B's in English. This advantage in terms of grades, however, does not lead them to be more interested in science. Rather sex reduces the likelihood of their interest in science. As might be expected, Mexican Americans are more likely to report C's and D's in English.

English appears to have two effects. Mexican Americans who speak English with friends and presumably are associating with Anglos develop an interest in science. Competence in English is not a barrier to interest in science insofar as A and D students are interested in science. Proficiency in English, however, may be a barrier to fulfilling these interests because students who receive poor grades in English may lack basic reading and writing skills.

As general measures of acculturation, students' and parents' birthplaces were analyzed using United States, Hispanic countries and all other nations as categories. Students' and mothers' birthplaces were independent of interest in science for all students. Fathers' birthplace was associated only among Anglos; those students whose fathers were born in non-Hispanic countries were more likely to be interested in science than those of fathers from Hispanic countries or the United States. Therefore, stereotypes about Hispanic culture as "anti-scientific" appear to be unfounded.

A measure of family orientation was derived from a question which asked why students might stop going to school? The answers were grouped together into four categories: will complete education desired, financial reasons, family reasons, and personal reasons. Family orientation does seem to affect interest in science. Those who picked financial reasons are the most interested in science followed closely by those who believe they will complete the education desired. Those who chose family reasons are less interested in science followed by those with personal reasons. Both personal and family reasons may offer students an alternative orientation to that offered by the educational system.

Turning to the distribution of reasons by sex and ethnicity, there is little variation by sex. Anglos were more likely to believe they would complete their desired education and Mexican Americans were more likely to give personal reasons or family reasons.

Finally, five characteristics of self image were examined with respect to interest in science. Students rated themselves on a five point Semantic Differential Scale. The associations were partitioned in order to collapse

categories that were not significantly different across all four sex by ethnic groups. The patterns of association are similar for self confident and intelligent. Across all sex and ethnic groups, those who describe themselves as highly self confident or intelligent are more interested in science. Dependence - independence exhibits a curvilinear shape such that those who are on either end of the scale are more interested in science than those in the middle categories. Creativity varies by ethnicity by the general trend is linear. Those who rate themselves higher on creativity are more likely to be interested in science. Competitiveness varies by sex and the results are particularly interesting. For males, rated competitiveness makes no difference with respect to interest in science. Among girls, those who rated themselves highly competitive are more likely to be interested in science. Efforts to improve students' self perception as intelligent, self-confident and creative would increase interest in science. These efforts could be aimed at girls and minorities insofar as boys and Anglos describe themselves as more intelligent and creative and boys give themselves higher ratings on self-confidence. Insofar as girls and Mexican Americans became more similar to boys and Anglos in viewing themselves as intelligent, self-confident and creative, more equal interest in science would be likely to develop.

Social Factors Associated with Interest in Science

The Family

Students were asked a series of questions about the support, encouragement, help and expectations they received from their parents and siblings. Each general question about school, i.e. "how much does your

father encourage you to learn," was subdivided into four subject areas (math, science, English, and social studies). Those responses specific to science are of interest here. For most of the results, under the preferred model of association, sex and ethnicity affect both the explanatory variable, social factors in this case, and interest in science. These results could be presented schematically as in Figure 5. Because sex and ethnicity have two effects, their association with the explanatory variable will also be discussed. Cases that deviate from this model, e.g. no effect of sex or ethnic on the explanatory variable or an interaction between sex or ethnicity and the explanatory variable, will be explained.

It should be noted that the effect of explanatory variable does not fully account for the sex and ethnic differences in interest in science. If it did, only the association of sex and ethnicity with the explanatory variable would be significant. In terms of strategies for change, interest in science can be increased by changing the levels of the explanatory variable. However, since under this model all students are affected by the explanatory variable, this change would result in increasing interest in science for boys and girls, Mexican Americans and Anglos, and the differences between these groups would remain. If the goal is to reduce differences by sex and ethnicity, programs can be designed which focus upon explanatory variables in models where sex and ethnicity have small net effects on interest in science or efforts can be made to alter the relationship between sex, ethnicity, and the explanatory variable.

First, students were asked how important their parents thought learning science was. Each question was asked twice, once with father as the referrent, once with mother. The overall pattern is linear; the more

important learning science is to mother or father, the greater the students' interest in science. With respect to mother, the relationship is monotonic as illustrated in Figure 6. For fathers there is an upturn at the low end, such that students whose fathers who are perceived as thinking science is not at all important are more interested in science than those whose fathers believe science is slightly important. The results for parents' encouragement to do well in science are similar. The pattern for mother's encouragement is linear and monotonic. For fathers the ordering of the categories in terms of decreasing interest in science is always, sometimes, often and never. In all of these models, sex and ethnicity continue to have independent effects on interest in science. Sex and ethnicity are independent of importance of science to parents and parent's encouragement. Thus, boys and girls, Anglos and Mexican American report getting the same encouragement from parents.

Students were also asked whether they usually went to their parents for help in science. Anglo students are more likely to get help from their parents in science. Students who got help from their mothers in science were more interested in science, although sex and ethnicity continue to have effects. Ethnicity also affects the likelihood that mothers help. Twenty-two percent of the Anglo students but only seventeen percent of Mexican-American students get help from their mothers. The effect of father's help interacts with sex and ethnicity. As can be seen in Figure 7, father's help has the greatest effect on interest in science for Anglo boys, a moderate effect on Anglo girls and Mexican-American boys and no effect on Mexican-American girls. These findings suggest that fathers of Anglo boys convey greater interest or concern over their sons' science

homework which increased the sons' interest in science and that other students may get less enthusiastic or positive reactions from their fathers. Or it may be that Anglo boys who are interested in science seek out their fathers help with science homweork while other students are less likely to do so. In either case, whether fathers help with science homework had differential effects across the sex and ethnic groups. Help from brothers and sisters was unrelated to interest in science.

Two questions were asked about parents' educational expectations: the importance to parents that the student attend college and the amount of education the parents wanted the students to complete. In both cases, sex, ethnicity and parental expectations are related to interest in science. The more important college attendance is to parents, the more students are interested in science. Parents who wanted graduate school, then vocational/technical education, had children who were more interested in science than those desiring college or just high school. Ethnicity affects the importance to parents of college attendance, such that Mexican Americans report that attending college is more important.

The final set of questions concerns how important to students are parents. Respondents were asked to rate how important having various people think well of them was. Students who rated mother's and father's impressions higher are more interested in science; sex and ethnicty have independent effects on interest in science. Fathers' importance did not vary by sex and ethnicity, but mothers were rated as more important by Mexican-American students. Since parents are generally suppportive and encouraging of learning science, it makes sense that when parents mean more to students, students have a greater interest in science.

These results indicate that parents' support and encouragement of science, while not explaining sex and ethnic differences, have independent effects on interest in science. Parents of Mexican-Americans and Anglos, boys and girls are perceived as being equally supportive and having similar expectations. Thus, increasing parental support and expectations would increase all students' interest in science. Help from fathers has different effects across the sex and ethnic groups. Anglo boys' interest is greatest when they get help from fathers. One strategy for improving Mexican Americans' interest in science would be to increase the likelihood that they get help from parents with their science homework. The findings can be interpreted as indicating that Anglo and Mexican-American parents are as supportive at a general level, but that Mexican-American parents are less likely to provide more direct, focused support, such as helping with homework. We turn now to data from parent interviews to support this interpretation.

Parents' Viewpoint

Parents were asked a series of questions about their perception of the education their children were receiving. Mexican Americans are more likely than Anglos to believe that the school was doing a good job of preparing students for education beyond high school. However, there are differences in frequency of the suggestions parents made for ways the schools could improve this preparation. First, Anglo parents are more likely to give two suggestions while Mexican Americans are more likely to give one or not to know. Parents of Anglo boys stressed higher standards and more preparation in the basics. Parents of girls suggested more individual attention and smaller classes. Parents of Mexican-American boys wanted

more individual attention and higher standards.

Mexican Americans are also more likely to know that the school has parent-teacher conferences, more likely to attend these conferences and extra-curricular events, and more likely to believe they have a good effect. In terms of both the amount of education they would like to see their children complete and the amount they expected the children to complete, the expectations of Mexican-American parents exceed those of Anglo parents.

However, when the questions focused upon specific help or advice, Mexican-American parents are often unable to translate their general support into direct actions. For example, Mexican-American parents are more likely to report that they encourage their children to do well in school, and the parents of Mexican-American boys provide more encouragement in science specifically. In terms of the ways that parents provide encouragement, differences emerge. Mexican Americans are twice as likely to stress the importance of education for success and more likely to praise or counsel their children. Anglo parents are four times as likely to believe that their children do not need encouragement. Parents of Anglo boys are three times as likely to enforce discipline and parents of Anglo girls nearly four times as likely to help with homework. Mexican-American parents are three times as likely to report that they encourage studying and on the average expect their children to spend twice as much time studying than Anglo parents do. In terms of science in particular, Mexican Americans, especially the parents of boys, report more frequently encouraging their children to do well in science, and to rate the learning of science as more

important. Mexican-American parents realize, however, that their children may be doing less well in school insofar as they are more likely to report that their children are average or below average in science. In summary, Mexican-American parents report providing many kinds of general encouragement.

Anglo parents, however, seem to provide more specific assistance. Anglo students reported getting more help from their parents in science and Anglo parents report more help with homework in general, although hardly any parents of either ethnic group help with science homework. Mexican-American parents report more frequent conversations about the school day and about students' performance.

When it comes to helping students select courses, the ethnic differences are striking. Among Anglos, 56 percent of the parents of boys and 67 percent of the parents of girls help select courses. Among Mexican Americans the comparable percentages are 29 and 44 percent respectively. This pattern can be explained by the finding that Mexican-American parents lack specific information about education upon which to base their advice and assistance. Mexican-American parents were slightly more likely to say they did not have enough information to help with course selection in response to a general question. However, when asked how much science was required for high school graduation, 80 percent of the the Mexican-American parents and half of the Anglo parents did not know. In terms of how much science the parents would recommend for students interested in attending the university, 36 percent of the Mexican-American but only ten percent of the Anglo parents did not know. Of those who gave an answer, Mexican Americans are more likely to recommend three or more years of science and more likely to believe three or more years are required. The state and the

university require one year of science. Having less information about the amount of science required leads Mexican Americans both to lack knowledge of and to overestimate the requirements.

Parents were also asked about occupational advise. In terms of science, they were asked what careers they would recommend if their children were interested in science. Mexican-American parents, and parents of Anglo girls to a lesser extent, were likely to respond "don't know." Forty-four percent of the Mexican-American parents and 20 percent of the parents of Anglo girls could not recommend a career in science compared to eight percent of the Anglo boys' parents. Doctor was the most popular choice among Mexican Americans followed by chemist for boys and a variety of choices for girls. Parents of Anglo boys suggested astronomy and engineering most frequently while veterinary medicine and biology were recommended for Anglo girls. Although a total of 31 occupations were mentioned, Mexican Americans were more likely to list jobs that required less education and training, such as lab technicians, electronics, and mechanics.

Parents were also asked their advice to three hypothetical situations. First, they were asked what advice they would offer if their child was trying to decide between a vocational or college preparatory program in high school. Although a majority of parents in each group chose college preparation, this response was more frequently endorsed by parents of Anglo boys and Mexican-American girls. Parents of Anglo boys were half as likely as other parents to pick the vocational program. Second, parents were asked what advice they would offer if their child were offered a scholarship to a state university 100 miles from home. Although 80 percent

of the parents said the student should take the scholarship, Mexican Americans were more likely to recommend this course of action. Finally, parents were asked what they would do if a teacher or counselor kept suggesting occupations that were far below their child's ability. Anglo parents were more likely to intervene in the situation (see the counselor or teacher, find out why) or let the child decide. Mexican-American parents were more likely to tell the child to ignore the teacher or counselor's advice.

In part, the differences in specific assistance or advice parents provide can be explained in terms of parents' own educational and occupational experiences. While 84 percent of the Anglo parents have a high school education or more, only one third of the Mexican-American parents have completed this much education. Two percent of the Anglo parents but one-third of the Mexican-American parents have only an elementary school education. In terms of occupations, both groups are equally represented in the professional, managerial and sales categories. Anglos are more likely to be employed in clerical, crafts and operative work or to be owners of their own businesses. Mexican Americans are more likely to be laborers, service workers or housewives. Thus, because Mexican-American parents have completed less education and obtained less skilled, less well renumerated work, they are limited in the specific advice and financial support they can provide their children. This is not to say they have lower expectations for their children. On the contrary, in spite of or perhaps because of the limitations of their own experience, they value education highly. When asked what advise they would give based on their own educational experience, Mexican-American parents were twice as likely to stress

the importance of education for success and three times as likely to suggest working hard. While Anglo parents also gave these suggestions, they were more likely than Mexican Americans to describe achievement (stay in school, achieve, plan carefully, get a respectable profession) or affective strategies (relax, do something you like).

Parents' own experiences are also reflected in the ways they think they can help their children. In helping them realize educational goals, Mexican-American parents are more likely to discuss finances or give money. In terms of helping the student choose an occupation, Mexican-American parents are more likely to tell the student what parents think is best for him or her or to give general encouragement or unspecified help. Anglo parents are more likely to specify how they would help (e.g. help plan education, help obtain experience, help find interests or aptitudes). Because Anglos have greater experience in educational and occupational institutions, they have more specific information and advice to give their children regarding their educational and occupational goals in general and science in particular.

Mexican-American parents are generally quite supportive of education and have higher expectations for their children's educational achievements. One strategy for increasing Mexican Americans' interest in science would be to provide these parents with more information about educational requirements, course choices and career options. Information on the percentage of women in the paid labor force and the potential renumeration for women in nontraditional careers, especially in science and engineering, would give parents an informed basis from which to advise their daughters. In general, support from parents exists. The school needs to tap into this

support and provide parents with information and strategies to channnel this support into more specific directive action.

The Peer Group

The peer group is less influential than parents vis-à-vis interest in science. The preferred models for importance of learning science to friends and friends' encouragement include independent effects of sex, ethnicity, and peers. Sex and ethnicity have two effects insofar as girls and Mexican Americans perceive their friends as believing science is more important and giving more encouragement and yet in spite of this encouragement have less interest in science. Peers are perceived as having less positive attitudes toward science than parents. Although the majority of parents are perceived as encouraging science and rating it important, the majority of students' friends are perceived as believing science is of little or no importance and as encouraging the learning of science a little or not at all.

The amount that friends help with science and the importance students place on having friends think well of them are unrelated to science. The amount of education friends want to complete is related to interest in science. The effect of friends' desired education varies by ethnicity. Among Anglos, the lowest interest in science is associated with having friends who desire a vocational or community college degree. Among Mexican Americans, having friends who desire a vocational or community college degree is associated with the greatest interested in science. Sex continues to have an independent effect on interest in science and is associated with friends' educational expectations insofar as girls perceive

more of their friends as desiring a college or graduate degree. This ethnic difference in the effect of friends' educational expectations may be due to divergent career interests for these groups. Mexican Americans, who want a vocational education, may be interested in science and considering technical occupations. Anglos who are going to college or graduate school may be interested in science and may be more likely to consider science oriented careers for which a college education is appropriate. This interpretation is supported by additional evidence. First, there are few role models in the science professions for Mexican Americans. Second, Mexican-American parents are more likely than Anglos to suggest technical occupations to students interested in science. Thus, the likelihood of translating an interest in science into the need for college training may vary by ethnicity.

Sel Role Stereotypes

Students were asked a series of questions about sex role attitudes. These attitudinal statements focussed upon sex roles within the family, in work settings, in educational, religious, and political institutions. One set of items was adapted from Fennema and Sherman (1976) to include the sex-typing of science as well as math. Two of these items were independent of interest in science. (Just as many women as men could be good scientists or engineers and boys don't like girls who do better than they do in math or science). The preferred model for "girls can do as well as boys in science" includes independent effects of sex, ethnicity, and this sex role attitude. The results indicate that students who are nontraditional are the most interested in science.

The next question focused upon whether men need to know more math than women. Under the preferred model, ethnicity has an independent effect and the association of the sex role attitude and interest in science varies by sex. As can be seen in Fugure 8, for girls, more interest in science is found among those with the most traditional attitudes. Among boys nontraditional attitudes are associated with increasing interest in science. Responses to the question about whether men would want to marry a woman who was interested in becoming a scientist or mathematician reveal a similar pattern. Among males, interest in science does not vary greatly by traditionalism of sex role attitudes. Among females the greatest interest in science is found among the most traditional, followed by the most nontraditional.

Two interpretations of these results are possible. First, the girls with very traditional attitudes represent a very small number of cases, particularly among Anglo girls. They may be qualitatively different than the rest of the girls. Second, it may be that girls with traditional attitudes can be interested in science because their long term goals conform to the traditional female sex role. For girls with nontraditional attitudes, educational and occupational interests may be more problematic insofar as they anticipate negative reactions when they deviate from prescribed sex roles.

Four other sex role items which focused upon the suitability of careers for women were included. The preferred model for three of the four yields independent effects of sex, ethnicity, and the sex role item. These three questions concern whether woman's place is in the home, whether jobs that have been held by men, such as scientist, are harder to combine with a family than jobs held by women, and whether girls who plan to work should

be counseled to enter "feminine" jobs. As can be seen in Figure 9, students who hold traditional and moderately nontraditional positions are similar in the lack of interest in science. Individuals with strongly nontraditional beliefs on these questions are more likely to be interested in science.

The final question on whether career education for boys should have higher priority with teachers than career education for girls yields an interaction with sex. Among boys, those with nontraditional attitudes are more interested in science than those with traditional beliefs (although an independent ethnic effect remains). For girls the effect is curvilinear. As found with some of the questions about sex-typing science and math, those girls who are most traditional are more likely to be interested in science, followed by those who are most nontraditional. The explanations of this pattern offered above are relevant here as well.

Sex role attitudes appear to be related to interest in science. Interest in science would be increased for all students by increasing nontraditional attitudes toward careers for women and the degree to which girls are believed to do as well as boys in science. The curvilinear results for girls on the items on the importance of career education, the need for women to learn math, and the marital desirability of women scientists deserve further study. It may be that very traditional girls intend to become housewives and, therefore, the association of their traditional attitudes with interest in science may not be important as the association for nontraditional girls. Reducing the sex typing of science and math may, in fact, increase the interest in science for nontraditional girls

and increase the orientation toward paid employment of traditional girls. The variation of these effects by sex indicate that changing these attitudes would affect girls and boys differentially.

Sex role attitudes are also influential insofar as they are embedded in social interaction. In other words, it is not just the individual's attitudes which influence behavior, but also the attitudes of others with whom one interacts. On eight of these nine questions, boys are more traditional than girls. The only question where girls are more traditional focuses upon boys' reactions, i.e., boys don't like girls who do better than they do in math and science. Similarly, on seven of the nine questions there are ethnic differences such that Mexican Americans are more traditional than Anglos. Thus, girls' interest in science may be influenced by the negative reactions they anticipate receiving, particularly from boys. This problem is expecially important for Mexican-American girls because Mexican-American boys are the most traditional group and Mexican-American parents have more traditional sex role attitudes than Anglo parents. Thus, efforts to reduce the sex-typing of careers in general, and of math and science in particular, would increase girls' interest in science both insofar as their own and their friends' attitudes changed. To the extent that sex and ethnic differences in sex role attitudes are expected to continue, programs might also be designed to help nontraditional girls cope with the nonsupportive reactions they receive from others (friends, parents, teachers) in their social interactions.

Educational Factors

Attitudes Toward Science

Several measures of students attitudes toward science focusing upon affective preferences, grades, effort and perceived usefulness were included in the questionnaire. Turning first to affective preferences, whether the student picked science as their favorite course is the only variable that fully accounts for the sex and ethnic differences in interest in science. Anglos are 1.8 times more likely to pick science as their favorite subject and boys are 2.3 times more likely to choose it. Under the preferred model, when the association of picking science as one's favorite subject and interest in science are included, sex and ethnicity no longer have significant effects. Similarly, when the course students chose as the subject they disliked the most is included, sex no longer has a significant effect. Girls and Mexican Americans dislike science more, but ethnicity continues to affect interest in science when disliking science is also included in the model.

These affective preferences do not offer an adequate explanation of interest in science because they are obviously so similar. Liking or disliking science is closely related to interest in science. These questions may be different measures of the same dimension, i.e., one's orientation toward science. We turn now to other dimensions which have more explanatory utility.

Grades in science are related to interest, but the effect of grade varies by sex. Overall, students who are receiving higher grades in science are more interested in science. However, girls at every average

reported grade are less interested in science and girls who receive B's are particularly discouraged from taking science. They are more likely to be probably or not interested than interested in science; boys who get B's are interested in taking more science. Once grades in science and sex are included, ethnicity does not have a significant independent effect. The fact that Mexican Americans are more likely to get C's and D's in science contributes to their lower interest in science.

Two measures of effort were included. First, students were asked how much they cared about getting good grades in science, and second, they were asked how hard they tried to do better when they weren't learning science. The preferred model for both includes an independent effect of ethnicity on interest in science and a joint effect of sex and caring about grades or trying to do better. The pattern of the results is presented in Figure 10. Among these students who care a great deal about their grades in science, interest in science is similar for boys and girls although ethnicity continues to have an independent effect. The association drops off more rapidly for females such that at all other levels of caring (quite a bit, somewhat, and not at all) girls and Mexican Americans are less likely to be interested in science. The results for trying hard follow the same pattern.

Caring about science grades and trying hard are associated with ethnicity. In terms of how much they care about science grades, Anglos are over-represented at the high and low ends of the scale; they are more likely to answer a great deal or not at all. In terms of how hard students try to do better when they aren't learning science, Mexican Americans are more likely to answer a great deal, quite a bit or not at all. Anglos are

more likely to report trying somewhat. The lack of longitudinal data makes separating the effect of grades on effort from the effect of effort on grades difficult. It may be that Mexican Americans report trying harder than Anglos because they are exerting additional effort because of their low grades. Or it may be that in spite of how hard they try, they receive lower grades in science.

The third set of questions asked students to rate the perceived usefulness of science. Students rated how important learning science is in helping them understand the world around them. Overall, about 40 percent believe science is very important and 30 percent believed it is quite important. Sex and ethnicity are independent of these ratings. The pattern of results for the usefulness of science in understanding life is similar to those for caring about and trying in science (illustrated in Figure 10). Boys' and girls' interest in science is similar when science is rated very important. However, girls who rate science less than very important are less likely than boys to be interested in science. Ethnicity continues to have an independent effect.

Second, students rated the importance of learning science in helping make decisions when buying products. One-quarter rated science very important and an additional quarter marked quite important. These responses vary by sex and ethnicity. Anglos and Mexican Americans are similar in their ratings of science as very important with respect to consumer decision making. Mexican Americans are more likely to respond quite important and Anglos are increasingly likely to give the lower ratings of importance (slightly and not important at all). Males are more likely to rate science very important, girls are more likely to give the other three responses.

When sex, ethnicity and the importance of science for consumer decision making are considered together, ethnicity and the importance of science are each associated with interest in science, but sex is independent of interest in science. Students who believe science is very important with respect to buying products are 1.7 times more likley to be interested in taking science than those who rate science quite important. Students who gave science ratings of slightly or not at all important are similar in their disinterest in science.

Finally, students were asked to rate the importance of learning science in helping them be good at the kind of work they expected to be doing for most of their lives. About 30 percent of the students rated science very important to their future occupations and an additional 25 percent rated it quite important. The responses vary by sex and ethnicity. As with the importance of science for buying products, Anglos and Mexican Americans are similar in rating science very important, but Mexican Americans are more likely to respond quite important and Anglos were more likely to indicate slight or no importance. The association with sex is linear and monotonic; greater importance is given by males.

The importance of science for future work has an effect on interest in science that is the same regardless of sex or ethnicity. The more important science is rated the more interested students are in taking more science. Students who rate science very important are three times more likely to be interested in science than those who rate it quite important. Sex and ethnicity have independent associations with interest in science.

Attitudes toward science could be changed to increase interest in science. First, Mexican Americans are more likely to get low grades in

science, and students who get A's and B's are more interested in science. Therefore, efforts to improve the grades of Mexican Americans in science would reduce the ethnic difference in interest. Girls who get B's in science are less interested in taking more science than their male counterparts. Encouragement for girls getting B's, who are able to do the work required for more advanced science courses, might increase the enrollments of women in science.

In terms of effort, girls and boys are similar in their interest in science when they are trying very hard or care a great deal about science. However, the association of effort with interest in science drops off more rapidly for girls. Strategies to increase the interest in science of girls who are expending effort but appear to be discouraged might increase the likelihood of their continuing their science education. Further research into the independent effect of ethnicity on interest in science may be necessary insofar as Mexican Americans report trying harder and caring more about grades in science and yet remain less interested in taking science courses.

The perceived usefulness of science for future activities is associated with interest in science. Efforts to increase the importance of science for buying products and for future employment in girls' estimation would increase girls' interest in science. In terms of ethnicity, although Mexican Americans rate science as more important to future work and for buying products, they are less likely to be interested in taking science. Therefore, efforts to increase their interest in science should concentrate on other factors which affect their course decision making, such as grades in science.

Attitudes toward Mathematics

The same set of questions that were asked about science were asked about mathematics. The results indicate that fewer of the attitudes toward mathematics than the attitudes toward science are associated with students' interest in taking science. In terms of affective preferences, students who pick math as their favorite subject are more interested in taking science and students who dislike math are less interested in taking science. Sex and ethnicity have independent effects on interest in science. The association of these affective preferences may be indicative of the extent to which math skills are used in science classes.

Grades in math and the extent to which students try hard to learn math are not significantly associated with interest in science. Caring about math grades is related in a curvilinear pattern to interest in science. Students who care a great deal or not at all are more likely to be interested in taking science. Sex and ethnicity, however, continue to have independent effects. This pattern may have two explanations. First, some students may have complementary interests, i.e. they care a great deal about their math grades and are also interested in science. Others may have compensatory interests; although they do not care about their grades in mathematics, they are interested in science. Because reported grades and effort in math are unrelated to interst in science, caring about math grades seems primarily to reflect a motivational orientation.

The perceived usefulness of mathematics was also expected to be related to interest in science. First, students may see the connection between learning science and future math-related activities. Second, students may be aware of math prerequisites for advanced study and potential employment

in science. The importance of learning math for buying products and for understanding the world are independent of interest in science. The importance of math for future employment, however, is related, along with sex and ethnicity, to interest in science. Those students who rate math as more important in terms of the jobs they expect to hold are more likely to be interested in science. There is an ethnic difference but no significant effect of sex in the ratings of the importance of math for work. Mexican Americans are more likely to believe that learning math is important for their future employment.

Students' interest in taking math is associated with their interest in taking science. Students who express a definite interest in taking math are more likely to be interested in science than those who are only probably or not interested in math. Sex and ethnicity have independent effects on interest in science under the preferred model of association. There is an ethnic difference in students' interest in math. Again, Mexican Americans are more likely to be interested in math than are Anglo students.

Attitudes towards mathematics reveal few strategies for increasing the participation of girls and minorities in science. Although students who like math care about math grades, believe math is important for future employment possibilities, and are interested in taking math are more likely to be interested in taking science, Mexican Americans have more favorable attitudes towards math on these measures than Anglos do. Increasing favorable attitudes toward math would affect all students' participation in science. Programs designed specifically for minorities do not seem particularly efficient since Mexican Americans already have more positive attitudes toward math than Anglos. Similarly, the only sex difference is

found with respect to caring about grades in math; girls care more about these grades than boys do. Although changing attitudes about mathematics may be important for increasing enrollments in math classes and interest in math related careers, it does not appear that such changes will alter the sex or ethnic differences in interest in science.

Educational and Occupational Aspirations

Educational aspirations and expectations were also examined vis-a-vis interest in science. Educational aspirations were measured with a question which asked students how much education they wanted. Expectations referred to the amount of education they actually expected to complete. Since more science is required as one advances through educational institutions, the expected association was linear. The results follow a similar, linear pattern of association. As can be seen in Figure 11, the more education students would like to complete, the more likely they are to be interested in science. Sex and ethnicity have independent effects under the preferred models of association. Sex also affects educational aspirations and expectations. Girls are more likely to want a high school or graduate education and less likely to aspire to vocational school, community college or college. In terms of expectations, a similar proportion of boys and girls expect to complete their education with high school graduation. Boys are more likely to expect to go on to vocational school or community college; girls are more likely to believe they will go to college or graduate school. Although girls may have higher educational goals than boys, they may be unaware of the science prerequisites or choices of major available to students who continue taking science and math courses. It

is also interesting to note that there is no significant ethnic difference with respect to educational aspirations or expectations although there continue to be differences in educational attainments across these groups.

Occupational goals are also related to interest in science. As can be seen in Table 4, all of the Anglo boys and Mexican-American girls who want to or expect to be scientists would take science courses. Anglo girls and Mexican-American boys are split between definitely and probably interested in taking science. Only around half of the students who aspire to other professions would take science and around 45 percent of the students who aspire to nonprofessional occupations express an interest in science. Sex and ethnic differences are apparent; within each occupational category, a smaller proportion of girls than boys, and Mexican Americans than Anglos, are interested in science. Increasing students' interest in careers in science would increase science course taking. Because Mexican-American and female students are less likely to be considering science related careers, programs designed to increase their occupational interest in science would reduce the sex and ethnic differences in interest in taking science and presumably in course enrollments as well.

Support and Encouragement from Teachers and Counselors

Students were questioned as to how much their counselor encouraged them to learn science, whether they usually went to their teachers or counselors for help with science homework, and how important it was that teachers and counselors thought well of them. Counselors' encouragement is related to interest in science although the pattern of association is not linear. Those students who get encouraged almost always are the most

interested, followed by those who get encouraged sometimes or never. Those who get encouraged often are the least likely to be interested in science. Those who receive little encouragment from counselors may have a moderate interest in science because they get encouragement from parents or peers or need little encouragement.

Sex and ethnicity continue to affect interest in science when counselor's encouragement is included in the model. Ethnicity also affects counselor's encouragement. Mexican Americans report more frequent encouragement from counselors than do Anglo students.

Counselor's help with science homework is independent of interest in science. Less than six percent of all students reported getting such help from counselors. However, students were also asked how frequently they had talked with their counselor about their plans for future work. Fifty percent had never had such a conversation with their counselor. The association between talking about work plans and interest in science is linear and monotonic. Although sex and ethnicity continue to have independent effects, as can be seen in Figure 12, students who have had three or more conversations with their counselors are twice as likely to be interested in science than other students.

The association of the importance of counselor's image of the student and interest in science is similar to that found for counselor's encouragement. If counselor's image is very important, students are most interested in science. Again sex and ethnicity have independent effects on interest in science. They also affect the importance of counselor's image. Mexican Americans and girls believe that their counselor's image of them is more important than do Anglos and boys.

Teachers' help with science homework is associated with interest in science. Those who get help from teachers are more likely to be interested in science. Sex is independently related to interest in science. Ethnicity is related both to interest in science and to the likelihood of getting homework help from teachers. Anglos are more likely to get help from teachers, most of whom are also Anglo, than are Mexican Americans. Teacher's image is associated with interest in science. Those who rate teacher's image as very important are most interested, followed by those who rate it as not important at all. Those who rate teachers' image as slightly important are the least likely to be interested in science. Sex and ethnicity affect interest in science and the importance of teachers' image. Girls and Mexican Americans believe that teachers' image is more important than do boys and Anglos.

Increasing the amount of encouragement from counselors, the frequencey of counseling with respect to work plans, and homework help from teachers would increase students' interest in science. Mexican Americans and girls may be particularly motivated by school personnel as they care more about the image they have with teachers and counselors. Providing more help on science homework for Mexican-American students would be particularly important with respect to increasing interest in science because Mexican Americans are less likely to get help from teachers and parents. Thus, teachers' help will not only increase science interest but will partially compensate for the infrequent help with homework that Mexican Americans get at home.

Teachers' Viewpoint

The teachers, who were interviewed for this study, were experienced personnel. The modal length of time in the teaching profession was seven to eight years. Most teachers were either recently employed by the schools where the study was conductd or had been there 10 or more years. They ranged in age from 22 to over 65. Half had children of their own.

Although the schools which were studied were selected because they had high minority enrollments, ethnic diversity among teacher is limited. Three-quarters of the teachers describe themselves as Anglos and only 14 percent are Mexican American. Because the focus of this research is upon math and science, half of the teachers interviewed taught these subjects. Ten of the twenty-three math teachers but only six of the twenty science teachers are women. Females are over-represented in English, reading, and business.

Teachers are more critical than parents of the job the school does in preparing students for further education. Twenty-three percent rated the school as above average or doing very well. An additional 23 percent gave it an OK rating. But 31 percent thought the school was doing poorly. The biggest problem the teachers identified was that students lacked basic skills. As solutions, teachers suggested improving basic skills preparation throughout the educational system and using higher standards.

Teachers were asked what they do when they encounter a student in their classroom who lacks basic skills. Eighty-two percent said they would try to help the student; the most frequent suggestions were giving individual help and providing encouragement for the student to work on basic skills.

If the student had the basic skills but lacked motivation, 85 percent to the teachers would try to help. Most frequently they recommended counseling the student or sending the student to a counselor, followed by talking to the parents and giving encouragement or praise.

These experiences are not unfamiliar to teachers. Thirty-two percent rated students in their classes as low in ability and fifty-five percent rated students as low in motivation. Only six percent gave students high ability ratings and nine percent rated motivation as high. Although teachers were divided as to whether lack of motivation, lack of basic skills or both occurred more frequently, teachers felt they were more successful in dealing with motivational than the skill problems (46 percent compared to 34 percent). These figures convey the irony of teacher's situation. They identify lack of basic skills as the primary deficit of the educational system, but they must first provide motivation for students to stay in school and be interested in learning this basic material.

While lack of basic skills is a problem identified within the school system, motivational difficulties are seen as originating outside of the educational institution. When asked why students stop going to school before they complete the amount of education which they desire, motivation was the most frequently given reason. Teachers believed students lacked self-confidence or became discouraged. Next teachers suggested that students set their goals too high, financial problems interfered, or education was not stressed at home. It should be noted that students and parents cite financial reasons as the primary barrier. Although lack

of interest was the second reason given by parents of boys, less than two percent of the students said they didn't like school and only three percent expressed a desire to quit school to work.

How can teachers encourage students to stay in school? Most suggested stressing the importance of education for life, getting jobs, or making money. Second, they recommended personal guidance. Teachers rate learning the subjects they teach as very important, and students report that teachers encourage them a great deal to learn course material. How effective is this encouragement that teachers, like parents, provide? Teachers' efforts to encourage students are limited by their ability to get to know the student since their efforts are directed at the individual level. As can be seen in Table 5, many teachers feel they don't have enough time to get to know students or to provide individual help. The extent to which teachers know about family background or educational and occupational aspirations varies across students. Therefore, although motivational problems are widespread, the information needed as the basis of personalized guidance appears to be lacking.

Most teachers describe their relationship with students as based on a counseling model. When asked to describe their teaching style, most teachers chose advisor, followed by friend and then task master. How then do teachers differentiate their role from that of counselors? Teachers perceive counselors' ability to get to know students as similar to their own but limited by having too many students and too little time. Teachers see counselors as supplying information on careers and financial aid and providing individual counseling. Teachers believe that teachers and counselors work together but that counselors have a key role in helping with problem students.

Teachers have limited interaction with parents. Seventy-two percent report that they deal directly with parents, usually through phone calls. Most teachers think that parent-teacher conferences are beneficial but that most parents don't come. Nearly two-thirds of the teachers do not attend parent-teacher association meetings. Thus, teachers do not appear to be working with parents nor getting to know pertinent family background information from family members.

Finally, teachers were asked to respond to six hypothetical situations. The sex and ethnicity of the students involved were systematically varied by changing the students' names. The first situation described an excellent student, interested in biology, and asked for advice on courses to take in high school and career options. Taking math was more frequently recommended for males than for females. Teachers suggested taking science generally across the sex and ethnic groups but did not mention specific courses very frequently. For Mexican Americans and girls, teachers were more likely to suggest that these students ask themselves whether a job in science is really possible. Among those teachers who were responding to the situation involving a Mexican-American boy, one-quarter gave this response.

In general, teachers seemed to take the situation of Anglo boys more for granted. They were more likely to mention a specific career in science or medicine for girls, more likely to advise seeing a counselor for girls and minorities, and more likely to send Anglo girls and Mexican-American boys to talk to a science teacher.

A second situation described a well rounded, model student who is offered a scholarship to a university 100 miles from home. The student's

parents object to the student going so far away from home. Teachers were most likely to advise taking the scholarship for Anglo boys, followed by Mexican Americans. They were more likely to recommend a compromise solution when the student was female. Teachers were equally likely to speak to parents for all groups except Anglo girls where they recommended that someone else should talk to parents. Teachers believed that the scholarship was the student's own decision more frequently for Anglo students and suggested that Mexican-American girls, in particular, needed to convince their parents of the decision.

Teachers were also asked which factors in the situation had been considered in their advice. Finances were more frequently mentioned for boys, the students' qualities for Anglo boys, the importance of the family for Anglo girls. Negative comments about the family trying to exercise too much control over the student's life were made more frequently with respect to Mexican Americans than to Anglos. These perceptions are in contrast to the parents' responses, which revealed that Mexican-American parents were more likely than Anglo parents to recommend that the student accept the scholarship.

Overall, the variation in teachers' responses according to the sex and ethnicity of the student described were less striking than expected. Teachers seemed to respond with general advice or to have their own idiosyncratic suggestions which they applied to all the situations. Sex and ethnicity may be more influential in actual interactions than in these hypothetical situations. In particular, they may affect the quality of the interaction and the amount of effort the teacher will expend in a given

situation. Further research is needed to identify the extent to which sex and ethnicity affect actual student-teacher interaction.

Counselors' Viewpoint

Fifteen counselors were interviewed. There is large variation in the structure of their work and extent of their responsibilities. The number of students per counselor averages 336 but ranges from 240 to 710. Counselors report seeing an average of 23 students each day. They primarily report dealing with scheduling problems, classroom behavioral problems, and personal problems. Most counselors feel they do not have enough time to get to know the students but feel they do learn about family background and students' aspirations. Counselors see their role in helping students reach their educational and occupational goals centered around facilitating goal clarification and providing information about careers and fianancial aid.

Counselors have limited contact with parents. They report calling parents when students have behavioral or attendance problems. These situations are usually handled over the phone and parents' cooperation in correcting the problem is solicited. Counselors also meet with parents to discuss family problems if the problems continue to affect students' performance or if parents initiate contact. Counselors see their role as intricately linked to teachers' roles. They descirbe this collaboration as a team, while acknowledging their specialization in dealing with student problems and the teachers' great contact and more frequent counseling of the "average" student.

Counselors primarily thought that schools could improve students' preparation for post-high school education by having smaller classes and improving the student-teacher ratio. They also were concerned about advanced classes that would challenge the above average student and about teacher morale.

Curriculum Structure and Tracking

Although tracking is officially prohibited, several procedures used in scheduling classes perpetuate a tracking system. Forty-six percent of the teachers said that students were not grouped by ability when they registered for classes. Forty-four percent reported ability grouping, primarily for math and English. Teachers thought this grouping was based primarily on teachers' recommendations, followed by past performance and placement or achievement tests.

Informal observations in classrooms and discussions with students partially revealed the tracking process. Students are often grouped on the basis of ability in English, which is required at every grade level. The rest of the scheduling is done by computer. However, the class is often used as the unit to be scheduled. Teachers would report that they had two biology classes in adjacent class periods; students in one class were consistently excellent, in the other below average. Talking with the students, it was discovered that students in each class also had English and most of their other required classes together. The English teachers reported that students in the first biology class came from an advanced English class. As mentioned earlier, students enrolled in English as a

second languages are particularly disadvantaged in course scheduling because the length of their English classes requires postponing other required classes and foregoing other electives.

Recommendations for Change

Teachers identified lack of basic skills and motivational problems as barriers to education. Counselors primarily deal with consequences of these problems. Teachers may need more training in counseling given the extent to which they are expected to provide such services. Teachers also need information on course options and career opportunities, particularly outside of their own specialization, insofar as they may have more opportunities to provide this advice than counselors. Teachers and counselors need to devise ways of coordinating parental support and encouragement with their own efforts. School personnel do not perceive the level of support from parents revealed in the parent interviews. In particular, the primarily Anglo teachers evidence negative attitudes toward what is perceived as control by Mexican-American parents. These teachers may feel uncomfortable in their dealing with these parents. Similarly, Mexican-American parents, who have limited experience with educational institutions and may have limited English skills, may feel reluctant about interacting with teachers and counselors. Efforts are needed to overcome these barriers so that parents', teachers', and counselors' efforts can be mutually supportive.

CONCLUSIONS

Recommendations for Further Research

This research has revealed that many of the factors associated with interest in science are complex, nonlinear relationships. Insofar as students who are both high and low on some characteristics or attitudes, such as caring about math grades, are more interested in science, further research is needed for a more complete understanding of these relationships. Second, there appear to be discrepancies between students' educational plans and occupational goals. Subsequent studies need to inquire about students' knowledge of math and science requirements and about their perceptions of the correspondence between educational training and career opportunities. What appears to be inadequate planning on their part may, in fact, reflect misinformation upon which they are basing decisions.

Career decision making is influenced by students' attitudes, educational factors, and parent and peer advice and support. In depth, longitudinal research would elucidate how students balance these competing influences. It may be that there are key decision points where one or another factor is predominant. This research has identified many of the influential factors, but more research is needed as to how students make sense of the multiplicity of factors involved.

Teachers appear to be generally supportive and to give general advice to students. Observational studies would help to specify in more detail the amount of information they convey about educational and occupational options and ways in which their counseling role can be improved. In

particular, teachers may need to be aware of current job opportunities and strategies for encouraging female and minority students to pursue these goals.

Recommendations to Increase Science Participation

The primary barrier to advanced training or employment in science is a problem of numbers. Because science education is a winnowing process, when the initial pool of interested students is small, the number who will proceed through the educational process is very limited. Until the number of girls and Mexican Americans who consider a career in science increases dramatically, the sex and ethnic characteristics of those who continue in science are unlikely to change.

For girls and minority students, the minimum required course work in math and science becomes the total amount taken. These students need to be more aware of the importance of their course taking decisions upon subsequent education and employment. These students need assistance from teachers, counselors, and parents in actively planning their course work to maximize their options. They need to anticipate advanced course work by enrolling in prerequisites, such as pre-algebra, and by satisfying requirements early so that they can pursue electives such as chemistry, physics, Algebra II and calculus. Female and minority students should be informed as to the content and usefulness of particular courses for subsequent training. With such information, they are less likely to be side tracked by "easy" courses, such as business math or general science.

Detailed information about careers in math and science, the related educational requirements, and the long term opportunities for advancement

would be of use to students, parents, and teachers. Because these careers utilize current technology, they change rapidly and up-to-date information may not be readily available. With respect to realizing educational goals, information on scholarships and financial aid should be provided to parents and students. Although girls have higher aspirations than boys, they have been less able to attain these goals. Programs designed to decrease the conflict that girls perceive between family obligations and educational aspirations would increase the likelihood of their taking full advantage of the opportunities available to them. In addition, strategies to reduce sex role stereotyping of science and math and to help girls cope with sex-typed messages meanwhile would decrease the sex inequity in science participation.

Several attitudes of students are related to interest in science. Efforts to improve girls' and Mexican Americans' self images as intelligent, creative, and self-confident would increase science participation because these characteristics are related to interest in science. Further research may be needed to determine why Mexican Americans get lower grades in science, but programs such as tutoring services or homework hotlines can be initiated in the meantime. Finally, Mexican Americans and females, who appear to be able but discouraged science students, need to be identified and provided support for continuing their science education. This recommendation applies to those girls who get B's in science, those students in both groups who care a great deal about science grades, those girls who try hard to learn science, and those girls who rated math as very useful for future activities. These students have positive attitudes, but unlike Anglo boys, they do not translate these attitudes as clearly into course taking decisions and career interests.

Finally, the family represents a relatively untapped supportive resource. Teachers and counselors are trying to counsel and encourage students on an individual level but are limited in their success by the number of students for whom they are responsible. Parents, particularly Mexican Americans, need to focus their support into more direct action. Information about educational requirements and career options would give these parents a more knowledgeable basis for their advice. Educators need to develop ways of involving parents in school projects, helping with homework, and assisting in course selections. The changes in the family will reinforce the encouragement to pursue science provided by the schools.

This research has identified social, educational and personal factors associated with interest in science. Educational and occupational interests are influenced by a variety of factors. This report has emphasized those areas which are amenable to change. The variety and number of factors suggest that there are several strategies which would increase sex and ethnic equity in science participation and which would increase the interest of all students in science. Insofar as various programs are begun simultaneously, the effects of any one will be reinforced by the efforts of others. The most consistent factors are social, in particular, the support and encouragement of parents, teachers, and counselors. The educational system has a unique opportunity to design strategies so that parents and educators can improve and coordinate their efforts to increase students' interest in science.

Figure 1
Number of Science Courses Taken by Grade, Sex and Ethnicity
(Expected Frequencies under the preferred model of association)

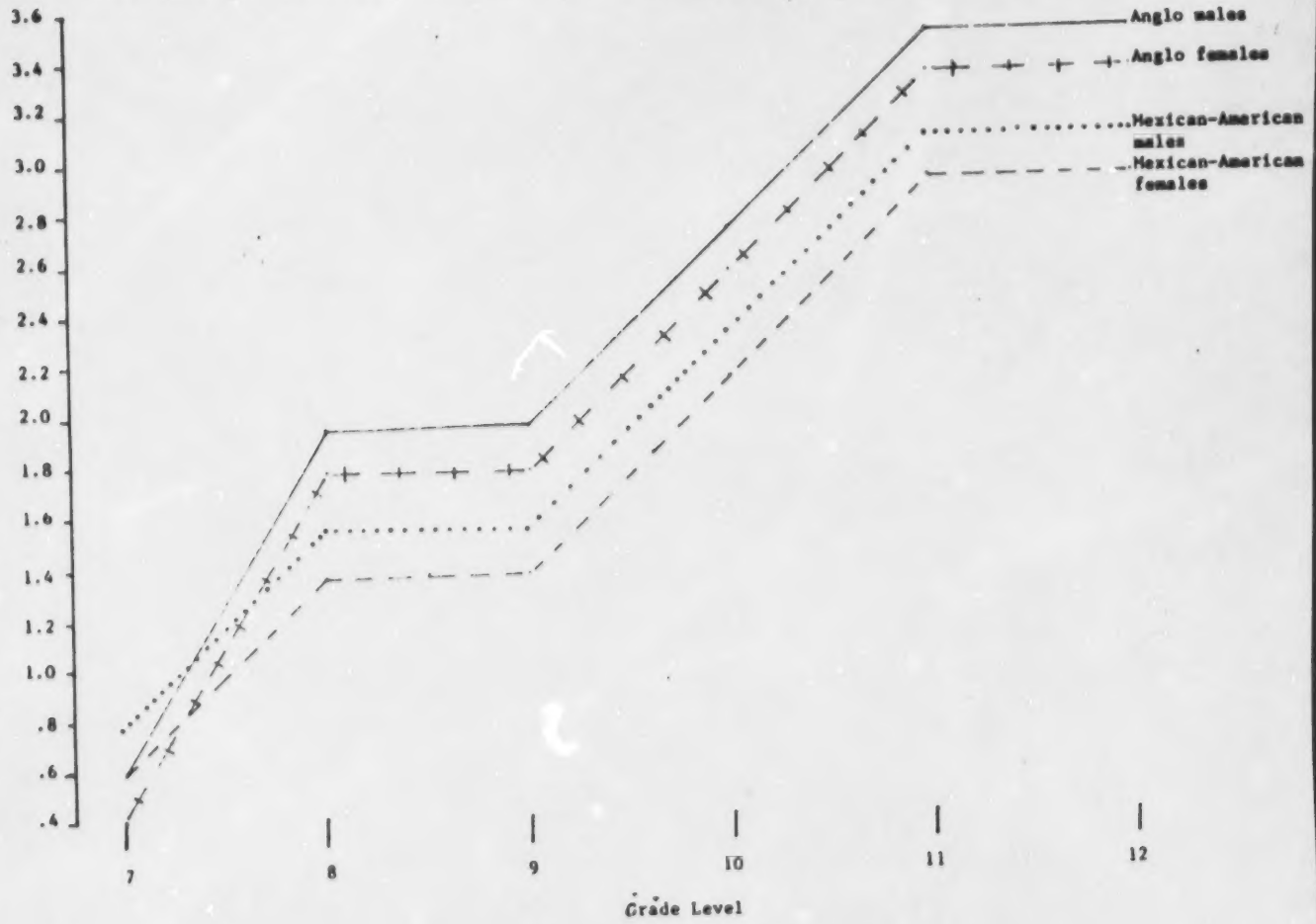

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Figure 2 A Nogales
Number of Math Classes Taken by Grade, Sex, and Ethnicity
(Expected frequencies under the preferred model of association)

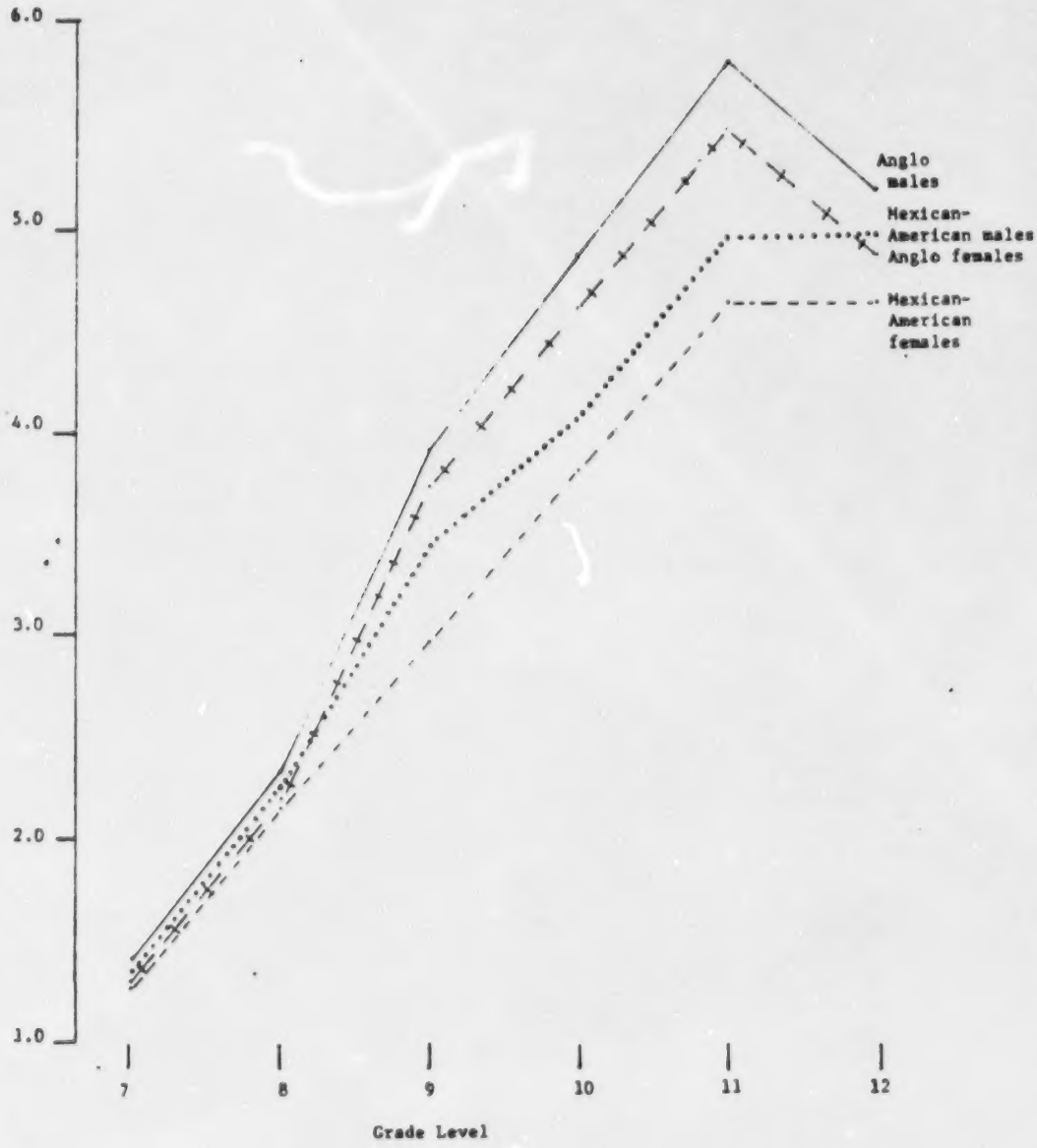

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Figure 2 B Tucson
Number of Math Classes Taken by Grade, Sex, and Ethnicity
(Expected frequencies under the preferred model of association)

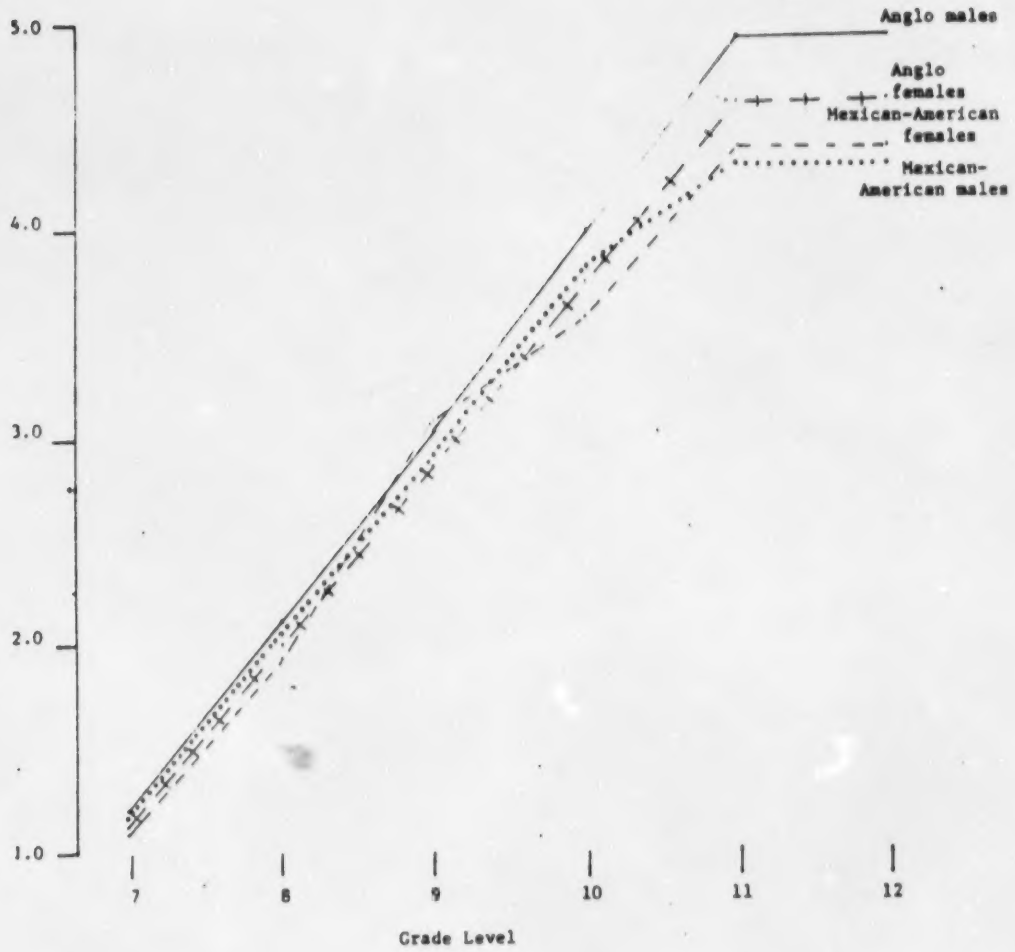

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Table 1

Participation in Specific Science and Math Courses
by Sex and Ethnicity

Observed Frequencies
Percent who have taken

	Males		Females	
	Anglo	Mexican American	Anglo	Mexican American
General Science	71.24	60.97	73.73	57.82
Biology I	52.56	54.10	47.88	52.73
Physical Science	29.06	31.09	25.42	26.06
Chemistry	20.94	11.57	13.56	10.42
Physics	4.70	10.63	4.66	8.48
Oceanography[2]	10.26	14.86	15.55	10.55
Biology II[2]	5.13	12.61	8.89	8.44
Bilingual Biology[2]	0	8.98	.42	6.08
Earth Science[1]	37.11	22.14	28.80	19.46
Science Lab Assistant	10.26	5.66	7.63	5.82
Independent Study in Science	9.83	5.52	7.63	4.61
General Math	33.75	42.80	27.12	39.76
Algebra I	44.02	45.96	59.32	42.06
Algebra II	16.24	17.50	13.13	15.03
Geometry	30.34	19.78	22.46	16.97
Pre-Algebra	32.48	31.49	28.81	25.21
College Algebra	5.13	1.88	1.69	2.18
Calculus	1.28	.94	.42	.24
Business Math	7.69	7.54	3.81	7.15
Bilingual Math[2]	2.63	5.26	0	2.90
Computer Math[2]	0	2.17	0	1.32

[1]Tucson Only

[2]Nogales Only

Table 2

Students' Occupational Aspirations and Expectations
by Sex and Ethnicity

Occupational Aspirations — Expected Frequencies as Percentages

	Males		Females	
	Anglo	Mexican American	Anglo	Mexican American
Scientist	5.96	3.28	4.11	2.31
Other Professional	36.55	32.67	48.37	44.05
All Other Occupations	53.97	59.07	45.57	50.84
Don't Know	3.51	4.98	1.94	2.80
(N)	(239)	(755)	(237)	(834)

$L^2 = 2.01$ with 3 df, $p = .57$

Scientist	7.52	4.14	4.61	2.50
Other Occupations	92.48	95.86	95.39	97.50
(N)	(229)	(719)	(234)	(809)

$L^2 = 1.21$ with 1 df, $p = .27$

Occupational Expectations

	Males		Females	
	Anglo	Mexican American	Anglo	Mexican American
Scientist	5.51	2.77	2.99	1.49
Other Occupations	94.49	97.23	97.01	98.51
(N)	(224)	(673)	(223)	(763)

$L^2 = .17$ with 1 df, $p = .68$

Table 3

Interest in Taking Science
by Sex and Ethnicity

Expected Frequencies as Percentages

	Males		Females	
	Anglo	Mexican American	Anglo	Mexican American
Yes	56.34	46.00	48.35	38.04
Probably	26.31	29.04	29.90	31.80
No	11.72	15.58	14.64	18.74
Don't Know	5.63	9.38	7.11	11.42
(N)	(232)	(692)	(224)	(780)

$L^2 = 2.32$ with 3 df, $p = .51$

Figure 3 A
Log Odds on Ethnicity by Interest in Taking Science, Males and Females, under the preferred model of association

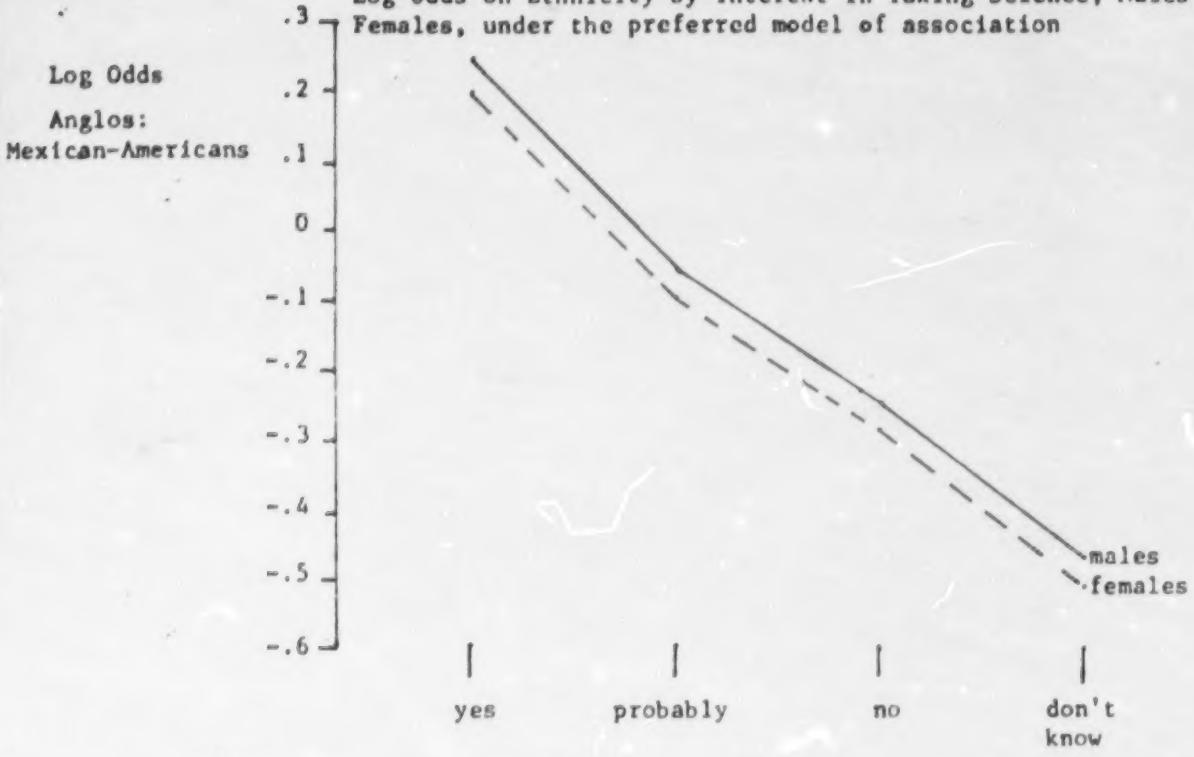


Figure 3 B
Log Odds on Sex by Interest in Taking Science, Mexican-Americans and Anglos, under the preferred model of association

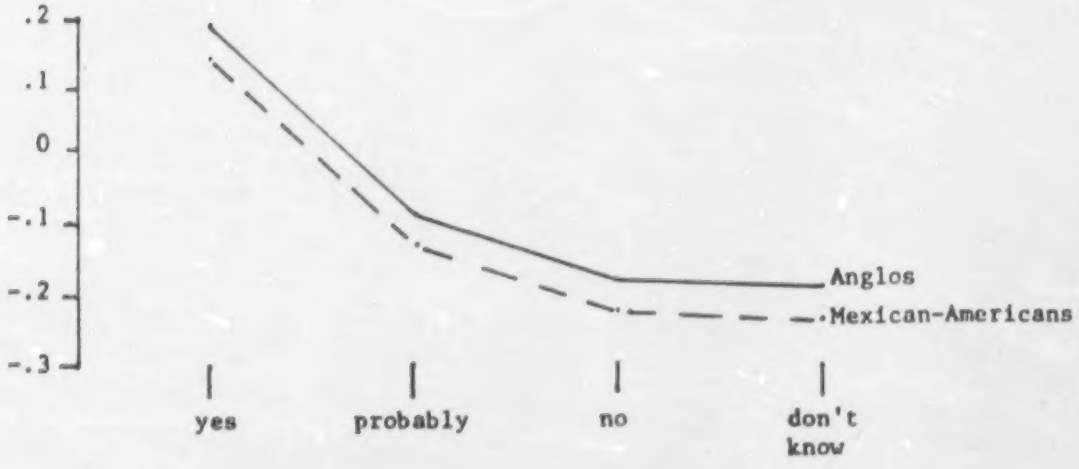


Figure 5

Schematic representation of the results under the preferred model of association

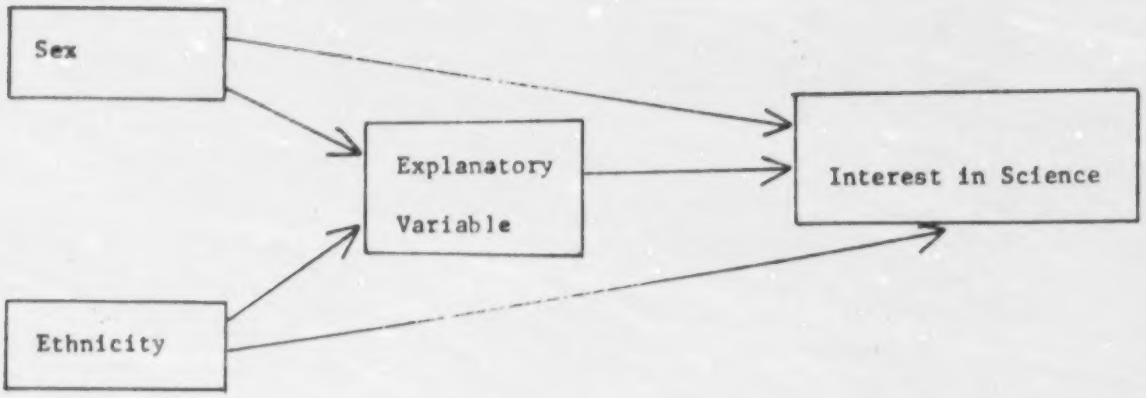
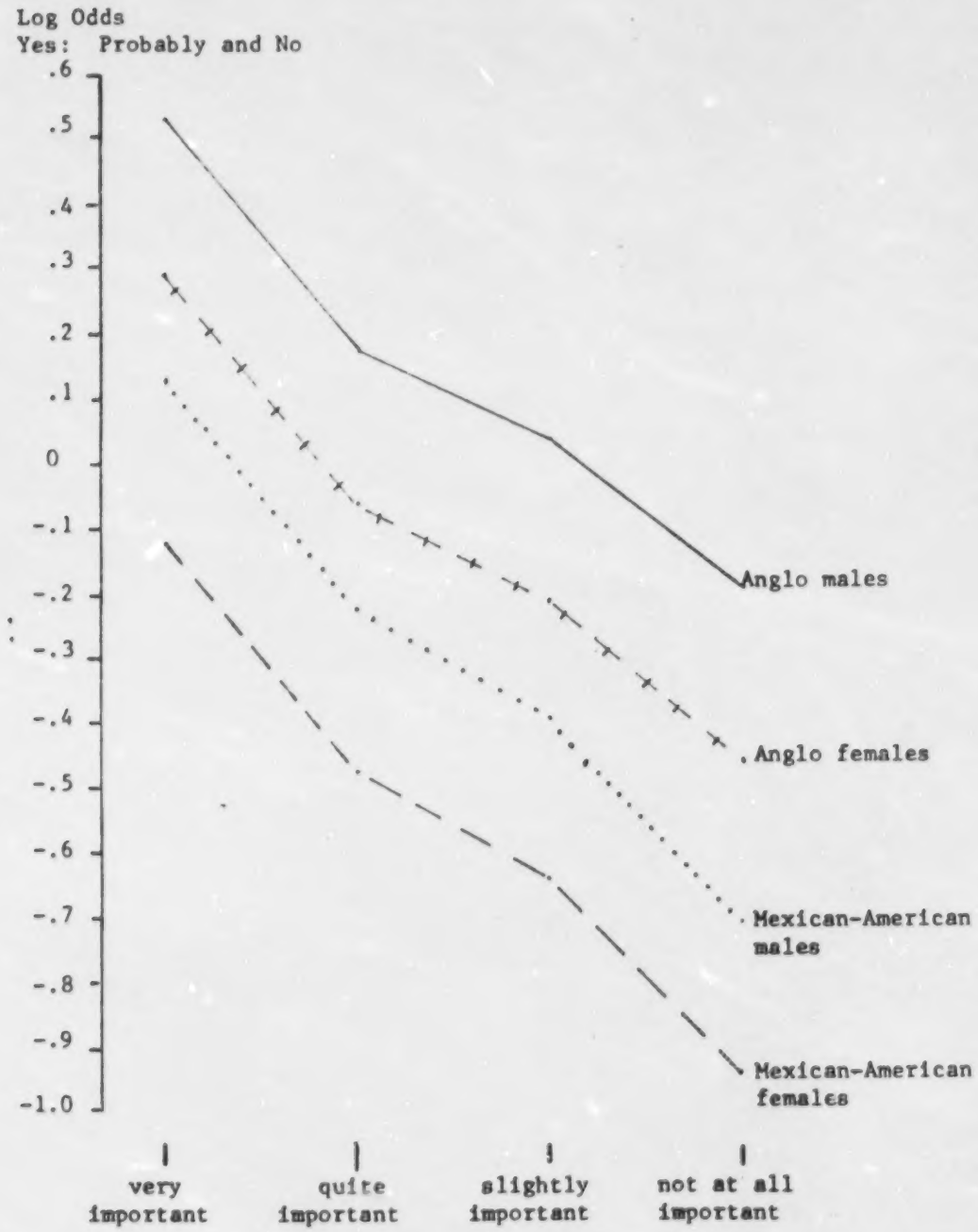


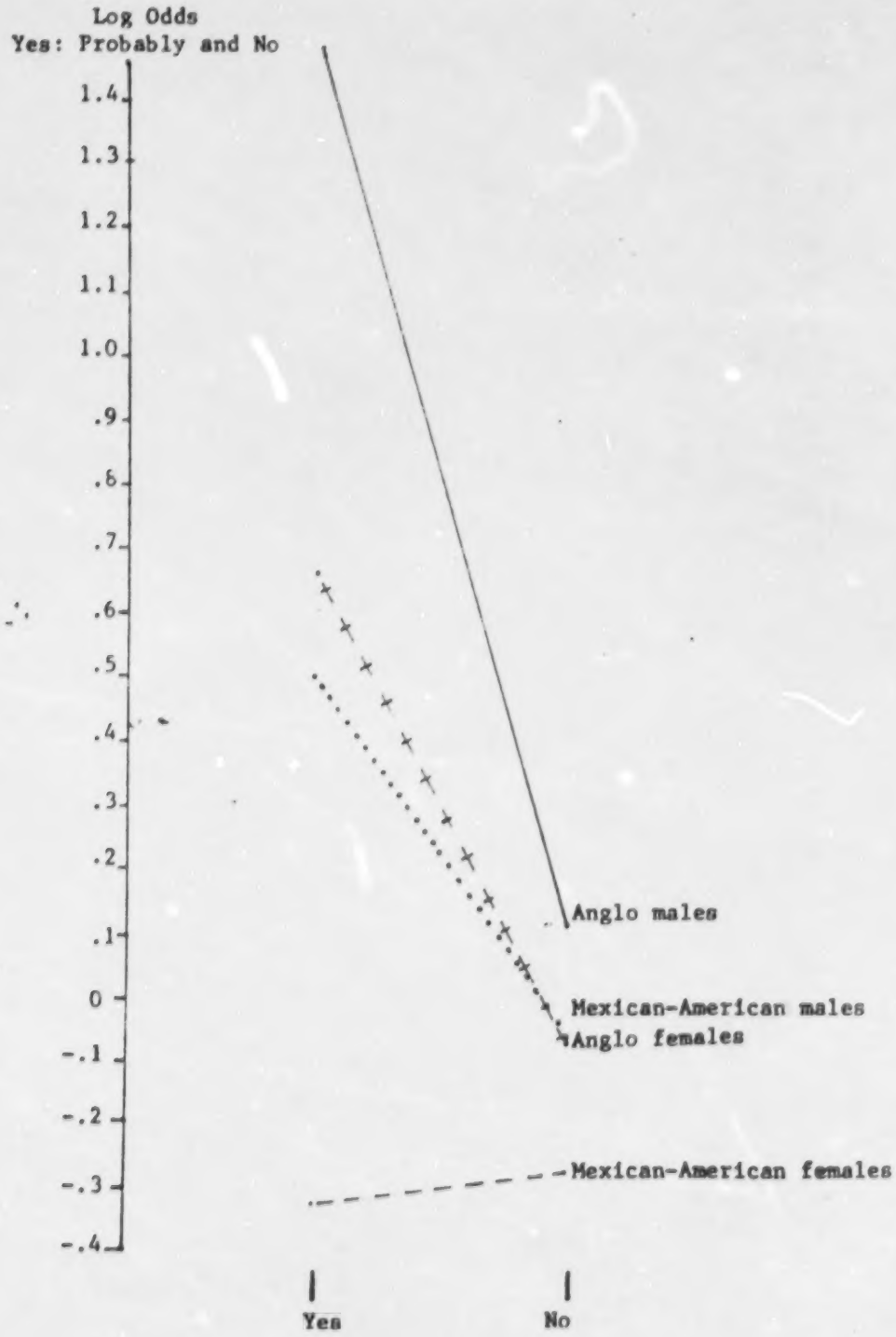
Figure 6
Log Odds on Interest in Taking Science, Yes: Probably and No, by Importance of Learning Science to Mother, Sex, and Ethnicity, under the preferred model of association



L^2 = 34.02 with 20 degrees of freedom, p = .0026

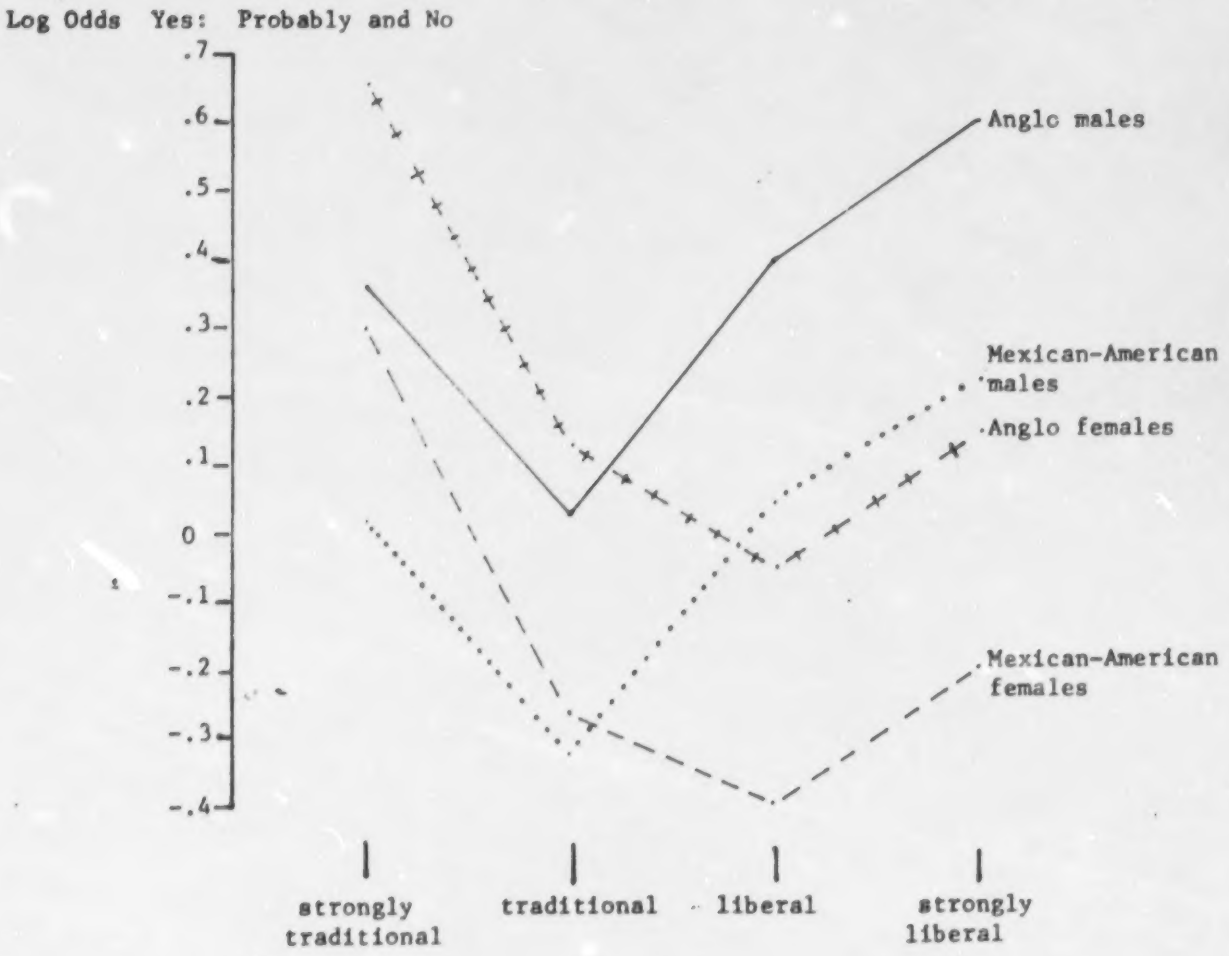
Figure 7

Log Odds on Interest in Taking Science, Yes: Probably and No, by Father's Help with Science Homework, Sex, and Ethnicity, under the preferred model of association



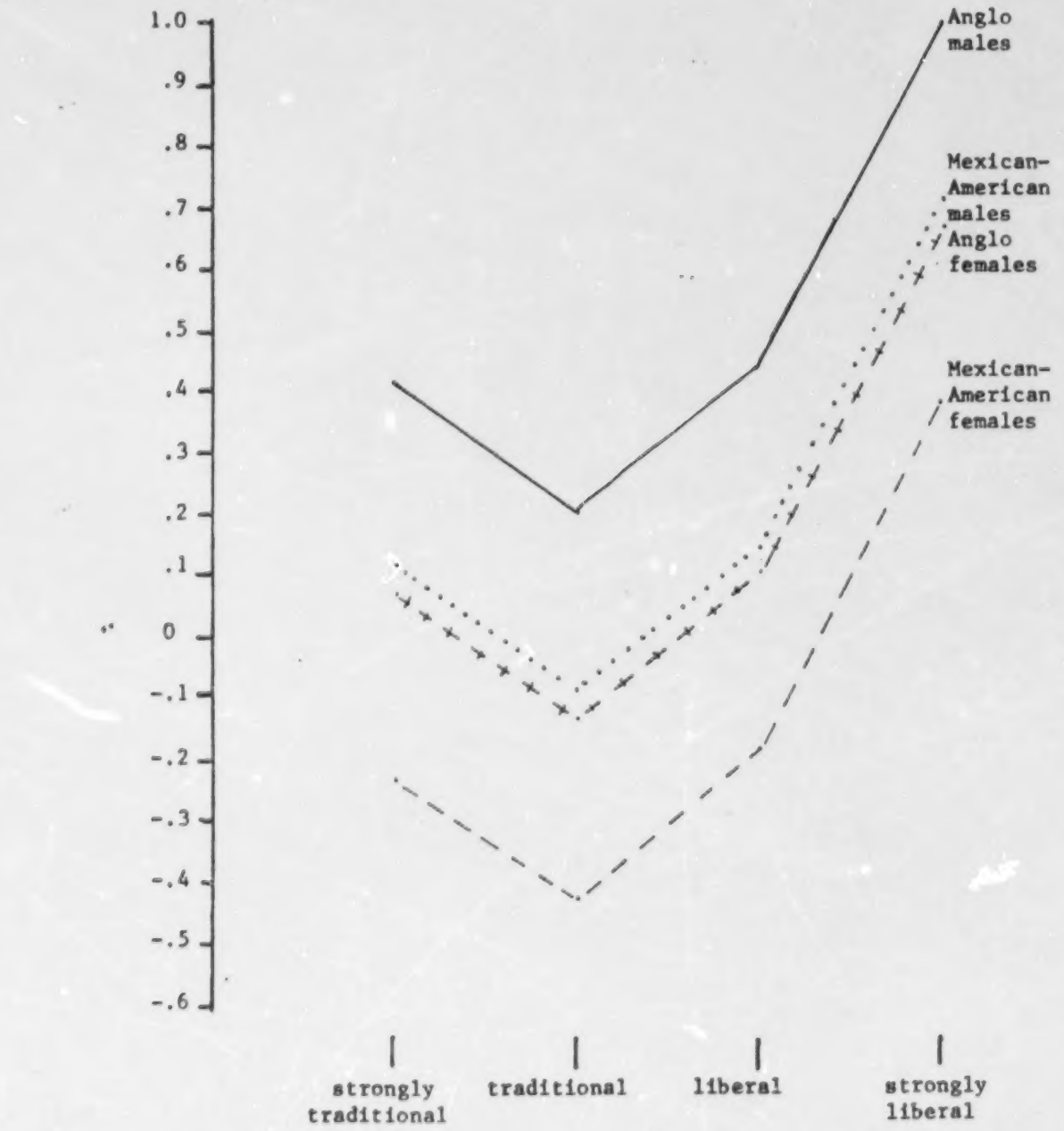
L^2 = 5.81 with 4 degrees of freedom, p = .2139

Figure 8
Log Odds on Interest in Science, Yes: Probably and No, by "Men need to know more math than women," Sex and Ethnicity, under the preferred model of association



L^2 = 14.77 with 14 degrees of freedom, p = .3939

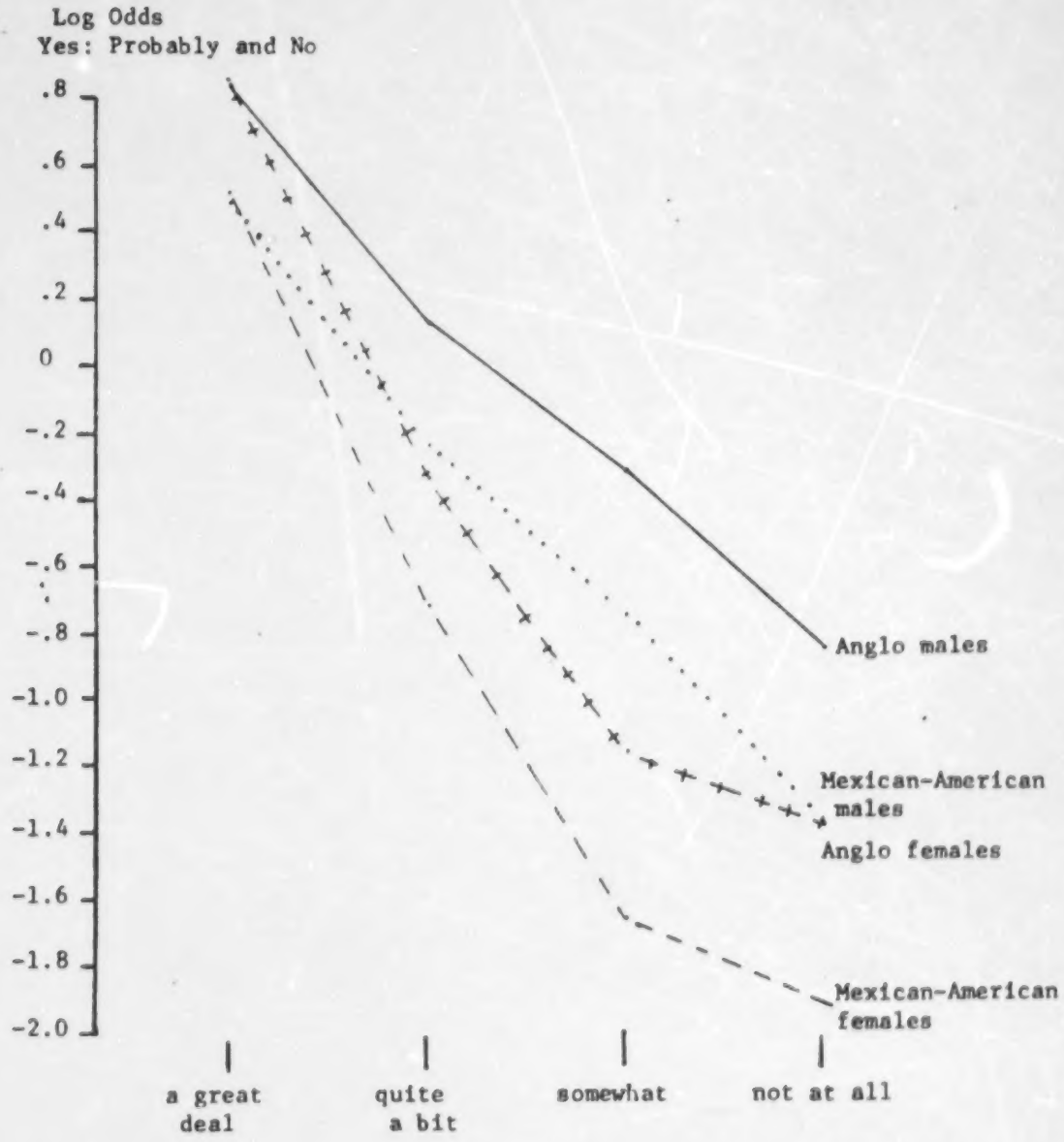
Figure 9
Log Odds on Interest in Taking Science, Yes: Probably and No, by Sex-Typing of Jobs Attitude, Sex and Ethnicity under the preferred model of association



"Jobs that have usually been held by men, such as scientist, are harder to combine with a family than jobs that have been held by women, such as librarian."

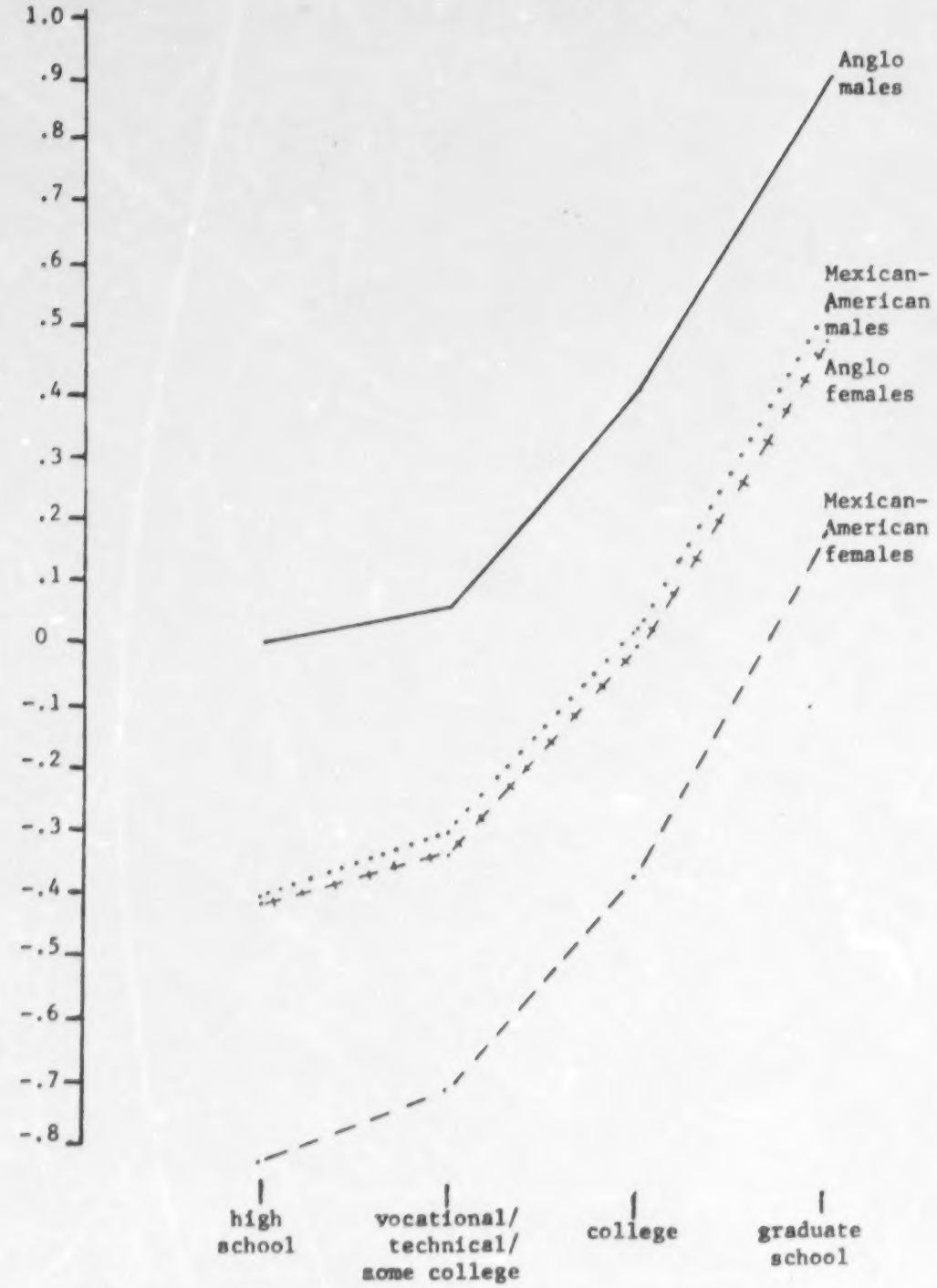
$L^2 = 13.70$ with 20 degrees of freedom, $p = .8451$

Figure 10
Log Odds on Interest in Taking Science, Yes: Probably and No, by Care about Grades in Science, Sex and Ethnicity, under the preferred model of association



$L^2 = 20.05$ with 14 degrees of freedom, $p = .13$

Figure 11
Log Odds on Interest in Taking Science, Yes: Probably and No, by Educational Aspirations, Sex, and Ethnicity under the preferred model of association



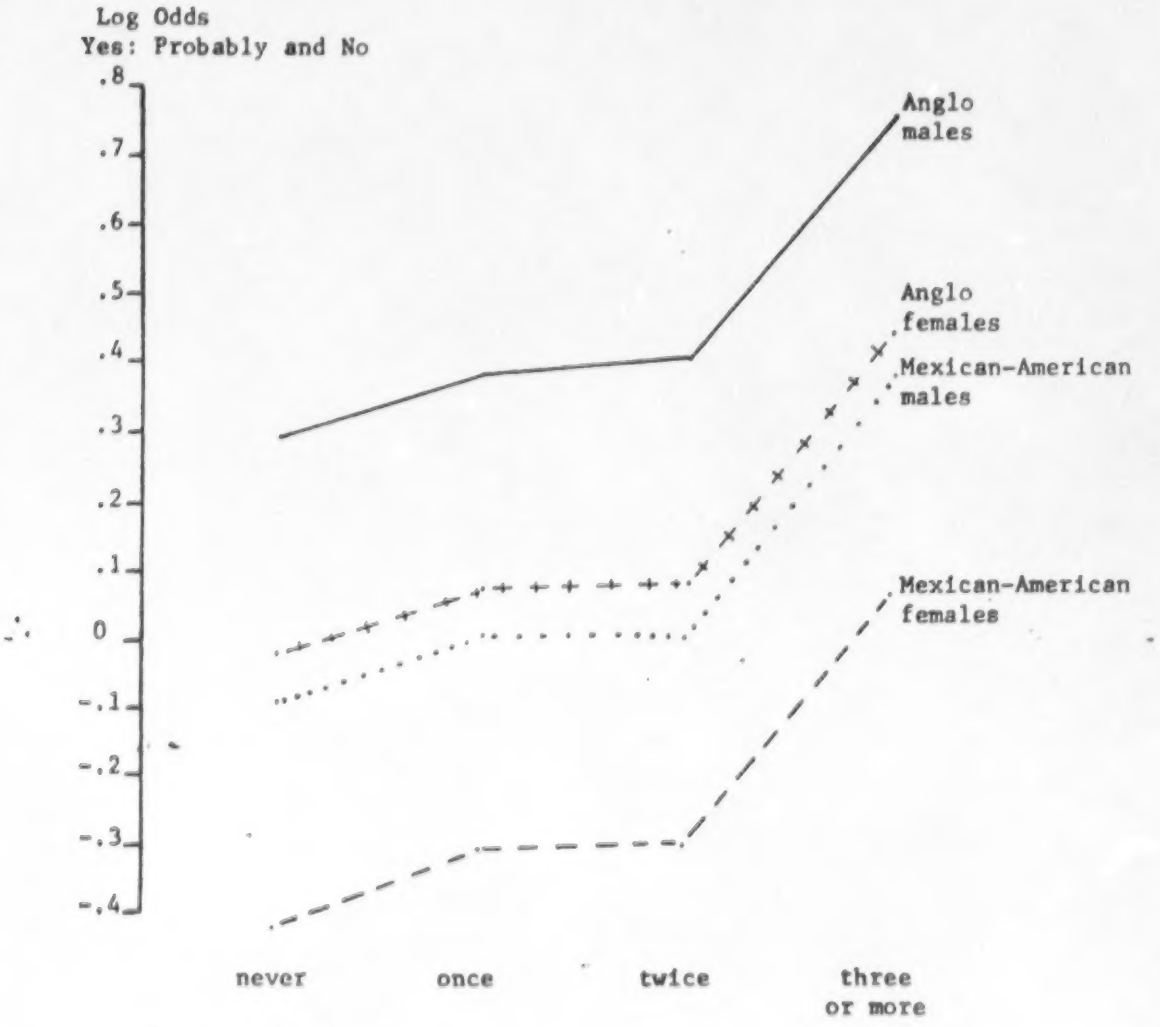
L^2 = 12.86 with 20 degrees of freedom, p = .8816

Table 4

Interest in Taking Science by Occupational Aspirations and Expectations, Sex, and Ethnicity

Occupational Aspirations	Observed Frequencies as Percentages											
	definitely interested				probably interested				not interested			
	Anglo males	Mexican American males	Anglo females	Mexican American females	Anglo males	Mexican American males	Anglo females	Mexican American females	Anglo males	Mexican American males	Anglo females	Mexican American females
Scientist	100.0	72.7	72.7	100.00	0	27.3	27.3	0	0	0	0	0
Other Professional	57.7	52.3	54.1	48.0	28.2	29.0	34.4	32.9	14.1	18.7	11.5	19.1
All other occupations	59.8	48.2	42.7	36.2	28.2	34.2	33.3	39.5	12.0	17.5	24.0	24.3
Occupational Expectations												
Scientist	100.0	64.7	66.7	100.0	0	35.5	33.3	0	0	0	0	0
Other Professional	60.3	53.5	52.1	50.2	28.6	28.3	35.4	33.0	11.1	18.2	12,5	16.8
All other occupations	58.3	47.7	47.9	36.5	29.1	34.2	30.2	38.3	12.6	18.2	21.9	25.1

Figure 12
Log Odds on Interest in Taking Science, Yes: Probably and No, by Frequency of Talks with Counselor, Sex, and Ethnicity, under the preferred model of association



Frequency with which student has talked with counselor about future job plans

L^2 =26.02 with 20 degrees of freedom, p = .1653

Table 5

Teachers' Perceptions of Interaction with Students

	% Yes	% Sometimes	% No
Do you feel that you have enough time to get to know the students in your class?	52.11	7.04	40.85
Do you feel you have enough time to give each student so that he or she can learn the subject matter?	33.70	14.00	52.30
Do you get to know about the student's family background and personal characteristics that may be important in terms of the student's progress in school?	25.00	59.52	15.48
Do you know enough about the students to be aware of their educational and occupational aspirations?	37.80	43.90	18.29

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